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On Granular Disease of the Conjunctiva and Contagious Ophthalmia. By EDWARD NETTLESHIP, F.R.C.S., Surgeon to the South London Ophthalmic Hospital. Late Clinical Assistant and Curator of the Museum at Moorfields Ophthalmic Hospital.

DURING the first quarter of the present century the group of diseases now known collectively as contagious ophthalmia received for the first time much attention. It was chiefly in relation to the havoc made by ophthalmia in the English and French armies during and after the Egyptian campaign that the many monographs and articles on the subject which appeared about that time were written. The commencement of destructive outbreaks of ophthalmia in the other European armies at various times between 1814 (Russia) and 1849 (Portugal) drew much attention to the subject on the part of medical men (and especially army surgeons) successively in each country of Europe. As a result partly of the study and skill bestowed on it, and partly of other circumstances, the violent forms of ophthalmia did not continue for long to prevail extensively in any one European army, although this comparative freedom from the disease was not attained till large numbers had been partly or entirely blinded by it in several countries. The importance attached however, both by the medical profession and the lay public, to prevalent destructive ophthalmia, has to a large extent been inherited in the present generation by its milder congeners; by forms of the disease which were common enough long before "army ophthalmia," or "Egyptian ophthalmia," were current phrases. The attention given to these milder and more protracted forms of ophthalmia is, however, due in part to other circumstances than the direct transmission of a newly created interest. Advances made in healthy and morbid anatomy have been the means of attracting notice to changes which could not have received the necessary attention without the light of our fuller knowledge. The superior claims of various very fatal diseases, *e. g.*, smallpox, typhus and dysentery, in earlier days when these were very prevalent in closely packed bodies of people, prevented close attention being given to such relatively unimportant affections as epidemic ophthalmia until a

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recent time. The higher standard of public health which has slowly grown up, and is still growing, has extended to contagious diseases of the eye as to all other maladies, so that far more importance is attached to the slighter forms of ophthalmia and other non-fatal affections than was the case fifty or sixty years ago.

At the present time ophthalmia, as a disease largely destructive or even injurious to sight, is unknown in the English army, and the number of cases diminishes almost yearly.¹ The same is, in general terms, true of the other European armies. In Great Britain it is chiefly among the children of the poor in large towns, especially of the Irish poor, that ophthalmia is now to be seen; while public attention to it is limited to those moderately severe forms which still occur in some of the poor-law schools.

Notwithstanding the abundant literature of the subject there is still, in this country at least, some uncertainty and want of agreement on the whole question of ophthalmia, more especially as it occurs in large institutions. That ophthalmia has within the last ten or twelve years occurred in a severe enough form to destroy eyes in more than one metropolitan poor-law school; and that in a less severe, but still a serious form, it has been for several years and still is, a very familiar disease in many of these schools, are facts requiring serious attention. It may here be observed, however, that the apparent increase of the disease in some schools within the last few years is doubtless partly due to the fact that much more attention is now given to the slighter forms of ophthalmia in pauper schools than was the case when a lower standard of health was applied to them. For this, among other reasons, the word "ophthalmia," if used without any qualification, is very misleading as to the real amount of harm done by the diseases which it is intended to define, being used, as it often is, to describe cases of every possible degree of severity and of several different kinds. It thus happens in the first place that those to whom the word has a very serious meaning are certain to over-estimate the real amount of the evil if they go no further than the number of cases returned under this heading by different practitioners, while it is probable that, from the want of a uniform standard, cases which one surgeon would regard as ophthalmia might be placed by another in a different category. I shall afterwards show that the number of cases which stand on this debateable ground is, in some instances at least, very considerable.

¹ Thus, the number of cases admitted into the Royal Victoria Hospital, Netley, for ten years, 1861—70, was 328, 230, 266, 233, 205, 126, 79, 97 (this increase in 1868 was due to the Abyssinian Expedition), 72, 39 (in 1870).—'Army Med. Rep.' for 1870, p. 351. The diminution is attributed to improvements in barrack hygiene at foreign stations. It seems probable that part of it is due also to the fact that since 1868 cases of gonorrhœal ophthalmia have been returned separately, no such distinction having been made in the returns up to that date. I am indebted to Professor Longmore for this information.

Then there is still much uncertainty as to the percentage of cases in which permanent damage to sight and incapacity for earning a living result from that kind of ophthalmia known as "granular." That bad granular ophthalmia often gives rise to very serious permanent corneal damage is of course undoubted. It is not, however, equally clear that the disease, even when severe, gives such a large percentage of bad results as is often attributed to it; and it is very doubtful whether, when mild or moderate, it is so serious an affair as we are sometimes led to believe. On the other hand, it is probable enough that some to whom opportunities for studying the disease on a large scale have been wanting are not fully aware of the injury caused by it. The principles of therapeutic treatment are well founded; there are yet a few points to be determined, however, with respect to the details which are most suitable, the length of time that treatment should be kept up, and the effects it should be expected to produce. It is also desirable to settle in as much detail as possible what are the best hygienic and educational measures to be taken in respect to large collections of children suffering from the disease.

The contagiousness of many of the forms of conjunctivitis has long been settled beyond dispute. It is indeed a question (and one of some importance for administrative purposes in large establishments) whether the doctrine of contagion has not been pushed too far with some forms of conjunctival disease, and made to account for facts which are in reality due to other causes. Whilst it is essential that the prevalent opinion on this subject should err, if at all, on the safe side, it is very desirable that this error should be as small as possible, and that a safe and sufficient prominence should be given to other influences. Some light is thrown on the causation of the diseases in question by an examination of their early history in this and other countries, especially as to the alleged freedom of Europe from severe prevalent ophthalmia up to the date of the Egyptian campaign of 1798 to 1802. The possibility of entirely preventing or stamping out ophthalmia from large institutions also depends much on the causes which produce it, and our belief on the latter subject will of necessity influence our action with reference to the former. The fact that ophthalmic hospitals do not furnish opportunities for a prolonged study of the various cases of conjunctivitis has prevented a full investigation of these diseases by some of those who have devoted themselves especially to ophthalmology; while the very large and prolonged experience of the disease enjoyed by many army surgeons and by the medical officers to some of the poor-law schools furnishes most valuable material for completing the unavoidable deficiencies in the experience of oculists. It is by putting the opinions of these two classes of practitioners side by side that we may hope to gain a sufficiently full and exact knowledge of the

disease without over-valuing its importance on the one hand, or bringing to bear on it insufficient means of therapeutic treatment or general management on the other.

The action taken in 1873-4 in reference to ophthalmia in the North Surrey District School at Anerley gave me, as Medical Superintendent of the Branch School established for the temporary reception and separate treatment of the patients, the means of studying those forms of the disease which are now most prevalent in such schools. I had under care for twelve months nearly 400 cases of the disease in its various milder phases, and had also the opportunity of observing to some extent the conditions under which it occurred at the Anerley School. These facilities together with a few opportunities which have occurred of inspecting the eyes of children in other schools, and the knowledge gained by attending the practice at Moorfields, have placed me in a perhaps somewhat unusually good position for judging some of the points above mentioned in connection with those forms of ophthalmia which are most prevalent in this country at the present time.

Dividing diseases of the conjunctiva roughly into those which are at some part of their course acute and those which are chronic throughout, we have in the former group the various forms and degrees of conjunctivitis, while granular ophthalmia (trachoma) is the most important member of the latter.

The fact, which has now been clearly known for about thirty years, that a person affected by granular disease of the conjunctiva is likely to suffer from a superadded conjunctivitis much more severely and for a much longer time than if his conjunctiva had been healthy when the conjunctivitis set in, gives the disease much greater importance than it would otherwise possess. This is recognised more or less clearly in all modern text-books, but is still sometimes lost sight of in the complications due to the frequent occurrence of the two types of disease simultaneously in the same patient. There are many cases of the milder forms of acute conjunctivitis which are of very little importance when they occur in persons whose conjunctiva was previously healthy, but which have serious results if at the time of their attack this membrane was in a more or less granular state.¹ A third disease which, though not properly conjunctival, sometimes exerts an important influence for harm on conjunctival affections is the chronic inflammation of the follicles of the eyelashes and of the meibomian glands and neighbouring struc-

¹ Although the word "granular" is here, and throughout this paper, used to designate the disease whose essential feature is the "vesicular" or "sago-grain granulation," I would not be understood to doubt that prolonged or repeated inflammation of a previously healthy conjunctiva, either with or without implication of the eyelash follicles and Meibomian glands, may give rise to permanent thickening and some roughness of the palpebral conjunctiva. I should doubt, however, whether this is common in any but old people.

tures which furnishes the different types of ophthalmia tarsi. It is, so far as I have seen, less common in schools than the two first classes and there is no need to discuss it at length here since its characters and management are well known.

Granular disease of the Conjunctiva.—For practical purposes it is convenient to treat this part of the subject first, especially because in the patients from whom most of my experience has been drawn it is so common that from a clinical point of view it almost must be studied first in order to appreciate rightly the bearings of the two classes of disease on one another.

Granular ophthalmia is a specific disease characterised by the enlargement of the minute lymphatic follicles normally present in some parts of the palpebral conjunctiva, by the formation of new structures which, so far as clinical characters are concerned, are identical with the above, and later by the slow hypertrophy of all the other conjunctival structures. The earliest changes occur at the outer¹ part of the lower lid near to the oculo-palpebral fold; at a later period the whole lid is affected and similar changes are found on the tarsal part of the upper lid and on the part of the conjunctiva which is above the upper edge of the tarsus. In the upper lid the disease begins at the extreme outer or inner end, or at both simultaneously, gradually advancing from these two points until the greater part or the whole of the tarsus is affected. In very mild cases the upper lid is scarcely involved.

The enlarged follicles are described in their early stage as “vesicular” granulations. They are at first quite transparent and only just visible to the unaided eye; their contents are said to be fluid enough to flow out when they are pricked. A little later on, when they are somewhat larger, less perfectly transparent, and will no longer collapse, they are called “sago-grain” or “spawn-like.” They are sometimes compared to tapioca when, at a much more advanced stage, there are present at and above the upper border of the superior tarsus large tracts or mounds of greyish white, almost opaque, new tissue formed either by the coalescence of separate granulations or the diffuse infiltration of the conjunctival tissue with new material. From the fact that much adenoid tissue is present in the tarsal conjunctiva and oculo-palpebral fold in certain very young animals² before any lymph-follicles are developed, and that

¹ Dr. Littlejohn, resident medical officer to the Hanwell poor-law school, whose opportunities for observing this disease in its earliest stages are very large, tells me he thinks the first signs of disease are found in the minute vesicular-looking elevations so often seen forming a single line parallel to and about $\frac{1}{8}$ -inch from the border of the lid at its outer part. I have been in the habit of looking on these as of doubtful diagnostic value. They will repay further study.

² Diffuse adenoid tissue is stated by Schmid to form the chief part of the conjunctiva palpebrarum and oculo-palpebral fold in many very young animals. Blumberg says nearly the same with respect to the dog. (‘Stricker’s Manual of Histology,’ New Syd. Soc.’s Translation, vol. iii, p. 450).

these are formed from it somewhat later in life (third week), it seems possible that in after life a formation of similar diffused tissue may occur as the result of disease.¹

The disease may advance no further than the formation of sago-grains on the conjunctiva of the lower lid, with or without a slighter degree of the same change in the upper lids. In such cases there is often no increased congestion of any part of the palpebral or ocular conjunctiva, nor any subjective symptoms. There is in many cases, perhaps in most if the truth could be ascertained, a slightly increased secretion of mucus, just enough to remain as a film on the skin at the inner or outer canthus when the tears which often run over at waking have dried up. The "sago-grains" may thickly cover the lower lids and yet there may be no morbid redness whatever. Such a state, few or many indolent follicular granulations without any perceptible change in the other conjunctival structures, will often remain stationary for a long time (many months or a year certainly, probably several years) and lead to no further damage. After a time the granulations gradually change to a yellowish or brownish-yellow colour, slowly shrink and at last disappear, their site being often occupied for some time afterwards by a small rusty-brown dot or pucker in the mucous membrane from which two or three minute but somewhat enlarged blood-vessels may be seen to pass. In other cases minute ill-defined whitish dots or streaks (scars) mark the former position of the morbid growths.

The formation of sago-grain granulations is often accompanied, either at an early stage or after they have attained a moderate size and number, by enlargement of the papillæ and chronic congestion and thickening of all the other conjunctival structures, including probably the tubular mucous glands which in man are found in the oculo-palpebral fold and some parts of the tarsus. The follicular granulations at the same time become congested and larger, though they may be partly or entirely hidden in the swollen tissues and hypertrophied papillæ around them. The conjunctival tissue in many cases takes part in the sago-like change, becoming much thickened by greyish gelatinous-looking material. When this occurs the sago-grains attain a large size and may coalesce with one another, and we then find an enormously thickened conjunctiva covered with bossy greyish-red elevations (large sago-grain granulations) separated by florid or dull-red enlarged papillæ. The entire membrane, being much extended in area, often becomes folded on itself to a remarkable extent. The degree of thickening and the size of the follicular granulations is sometimes very unequal on different parts of the same lid. I believe that the final stage of such a condition, whether affecting the whole lid or only a part, is always

¹ A similar suggestion has been made by Frank (1860) and others.

the partial absorption of the new tissue and the conversion of the rest into tough scar-tissue of white or yellowish-white colour. This will form a more or less isolated streak or plate, or will occupy the greater part of the lower lid, according to the original extent of the trachomatous change. Such plates are sometimes slightly raised and at others a very little depressed; they are always less flexible than the normal conjunctiva. When thin they may have a streaky, tendinous appearance. Sometimes by slow contraction they cause stricture of the lacrimal puncta or canaliculi,¹ or both, and more or less troublesome epiphora is the result. Often they do no harm whatever. I have never seen them, in children up to sixteen years old, cause alteration in the direction or curvature of the edge of the tarsus, except very slightly at the punctum.

Granular disease, as a rule, begins rather later on the upper than on the lower lids. In cases of the first degree, where there is throughout little or no congestion and papillary enlargement on the lower lids, the upper lids generally remain nearly healthy from beginning to end. In these mildest cases, however, a few small sago-grains are often found close to the inner and outer ends of the upper tarsus. They are generally accompanied by more or less congestion and papillary enlargement at the same spot. Sometimes the papillæ enlarge without any sago-grains being visible, either because these are not formed, or being present are obscured by the papillæ. The rest of the upper tarsus and retro-tarsal fold is often normal. In the next degree either the whole length of the upper edge of the tarsus shows abnormal redness with some papillary enlargement, or the entire tarsal surface loses its polish, and, owing to uniform slight enlargement of its papillæ, reflects light imperfectly. Both these changes occur together in many, perhaps in most cases. Now and then, although there may be only the very slightest papillary change, the tarsus is found to be thinly sprinkled with small circular flattish elevations like minute sago-grain granulations. They are quite pale like the surrounding conjunctiva and can scarcely be detected except by looking obliquely at the lid. It is commoner, however, to find no appearance of sago-grains (except just at the inner and outer ends) until there is slight but quite decided papillary enlargement and congestion over the whole upper tarsus. The surface is then of a more or less uniform red tint, sprinkled over with small white bodies of a flattened hemispherical shape. The smallest are only just visible to the naked eye, the largest nearly a millimètre in width. They are absent from that part of the lid nearest to the ciliary border, and are less plentiful near the upper border of the tarsus than about its central area. Sometimes they extend quite up to and mingle insensibly with the sago-grains before men-

¹ This occurred in three cases.

tioned at the inner and outer ends of the lid; in other cases they are limited, or almost so, to the central part of the tarsus. Occasionally only one or two are present on the whole upper lid. They are generally smaller, and almost always flatter, than the granulations at the canthal parts of the lid or than those on the lower lids. These small sago-grains on the upper lid cannot be mistaken for the enlarged and congested papillæ by which they are surrounded and which give to the conjunctiva the appearance of the finest sand-paper. They are, however, not by any means always present on the general surface of the upper tarsus, for in a considerable proportion of cases there is nothing to be seen but uniform congestion and the finest sandy roughness of this part. This congestion may be uniformly capillary, the larger vessels being quite hidden, or the larger vessels may be the more obvious, there being then coarse congestion without much alteration of the normal smoothness of the conjunctiva. It is worth noticing that the congestion affects last and when not uniform is slightest at, a small linear part of the tarsus situated midway between the two ends and about 2 mm. from its ciliary border. The large vessels all converge to or radiate from this area, which is exactly the part where, as we shall see later, scarring begins in severe cases of granular lid. In the later stage of a slightly or moderately granular upper lid there is a varying amount of subconjunctival thickening, considerable papillary enlargement, usually much congestion and many whitish more or less prominent sago-grains. In the place of some of the latter small slightly depressed pale streaks or dots are often to be seen, indicating absorption of previously existing granulations. The whole lid at this stage has a peculiar mottled colour and irregularity of surface which are highly characteristic.

The relative development of the papillary and sago-grain changes vary greatly in cases of the degrees above described. In a good many instances all the papillæ are so much elongated as to form a surface like the pile of velvet, different patches or rows of papillæ often separating from one another and leaving fissures which appear at first sight to be cracks in the mucous membrane. There may be no sago-grains visible on the upper lids even if any are present, and those on the lower lids may be almost or quite hidden by the velvety hypertrophy of the papillæ. That the essential element in the disease, even in these cases, is the sago-grain granulation is I think certain in almost all cases. In most *early* cases sago-grains are obvious enough on the lower lids at least, and in many of these velvety cases they reappear much more clearly during conditions of partial cure when the papillæ have much diminished in size. The natural ending of the velvety type of cases is in a gradual condensation of the over-grown papillæ, followed by shrinking and devascularisation. There is at last left a pale surface, perhaps partly scarred

and quite smooth in some parts and in others occupied by small, pale, tough, firm papillary granulations, looking like coarse sand. These are most abundant and largest at and above the retro-tarsal fold of the upper lid. They often remain in this state for years, probably for life.

Hitherto the three elements in the disease, follicular granulations, hypertrophied papillæ and diffuse (? adenoid) infiltration of the conjunctiva and subconjunctival tissues, have all been more or less completely appreciable by obvious differences. Although the relative amount of each change has been seen to vary largely, still the sago-grain (lymphatic follicle) granulation is the primary and essential constituent in every one.

In the severer forms of granular ophthalmia, although the sago-grain granulation is an equally important primary change, the morbid action extends so largely to the papillæ and the other conjunctival structures that it is often quite impossible to distinguish between follicular and papillary granulations. The papillæ, which in an early stage of disease are increased more in length than width, become in the more aggravated conditions gradually thickened, until they form rounded masses indistinguishable either by size, colour, or apparent consistency from the true sago-grain bodies. In some cases the papillæ may be seen in all stages of enlargement on different parts of the same lid at the same moment. The subconjunctival tissues now always become more or less infiltrated with inflammatory material. The appearance of the conjunctiva at this stage, its surface thickly studded with large florid succulent rounded "granulations," needs no description. It is in this state that most of the patients seek hospital relief.

The final absorption of the effused products in these bad cases is always accompanied by the condensation of a part of it into firm, white, tendinous cicatricial tissue. It is unnecessary to describe in detail the form and arrangement of these scars, further than to mention that the chief one is almost always found as a linear patch or band midway between the inner and outer ends of the upper lid, between the centre and the free border of the tarsus and parallel with the latter. The precedence taken by this part in the retrograde changes is no doubt connected with the fact that it is the least vascular part of the lid. This point, as has been already mentioned, is beautifully shown in many upper lids when in a state of moderate chronic congestion. The depth of scarring depends chiefly on the degree to which the subconjunctival tissue has been implicated in the inflammatory process. Bad results from changes in the curvature of the lids and permanent shortening of the conjunctiva are likely to follow in proportion to the *depth* of the scar, and in proportion as it affects the oculo-palpebral fold. It must be distinctly borne in mind that scarring is the natural termi-

nation of granular disease, when at all severe, if not interfered with. From the constancy with which it occurs in cases of the same degree of severity, from the invariable occurrence of the chief cicatrix in exactly the same part of the lid and this the least vascular part, and from the fact that treatment of precisely the same kind as has been used in severe cases never produces similar scarring in mild ones, there can, I think, be no doubt whatever that most of the cicatrices commonly met with now, especially the worst ones, are due to the disease having been allowed to go on without sufficient treatment, not to the use of too powerful caustic applications.¹ The scars following the spontaneous cure of granular ophthalmia may be fitly compared to those following the disappearance of non-ulcerating deposits of lupus, or the spontaneous cure of nævi.

Symptoms accompanying Granular Ophthalmia.—There is the greatest variation in the subjective symptoms of this disease, a variation which bears no relation at all, in *different cases*, to the objective changes, although in the same patient this relation remains almost always constant. The great majority of children with abundant sago-grains on their lower lids and often a good deal of congestion and papillary hypertrophy, will tell you they have nothing the matter with their eyes. Generally there is no photophobia whatever. There is often more or less drooping of the upper lid from elongation of the tarsal ligament and this gives the patient a sleepy aspect. This total absence of discomfort is quite common even in much more advanced cases where the conjunctiva of the upper and lower lids is crimson, thickened and converted into a mass of mingled follicular granulations and enlarged papillæ. There is no redness of the exposed part of the ocular conjunctiva, but often, perhaps generally, the parts ordinarily covered by the lids are more or less congested. This condition is most intense at the oculo-palpebral fold where it merges into the redness of the palpebral conjunctiva; gradually diminishing, its last traces are seen in a few of the larger conjunctival vessels as they straggle towards the cornea. The state of congestion of the palpebral conjunctiva is

¹ Sears do sometimes result from ulceration of the conjunctiva produced by treatment, but these are different both in position, appearance, and character from those due to the natural cure of the disease. They are generally found on the lower lid near its centre in the form of short wide bands joining together two principal folds of the conjunctiva which is in this position very lax and often much plicated. They are always preceded by superficial ulceration, and this generally takes place on the two opposed surfaces of a sulcus in the folded conjunctiva, and is the result of a too free application of nitrate of silver or lapis divinus to that part. I have never seen any distortion of the edge of the lid follow them. It very occasionally happens that similar ulceration and scarring occur on a small patch of the upper lid from the same cause; these scars are, however, abruptly circumscribed, quite superficial, devoid of the peculiar tendinous glistening of the spontaneous scars, and especially have no uniform position on the lid.

often very accurately shown by that of the caruncle, which by its red fleshy aspect often reveals a condition that might otherwise escape notice. These remarks on congestion apply to children seen in the daytime. In examining a number of cases just after waking in the morning it is not unusual to find several with some congestion of the exposed ocular conjunctiva. This soon disappears, a result probably due in part to the constricting effects of exposure to cold air.¹ The permanent congestion of those conjunctival vessels which are constantly covered by the lids is caused partly no doubt by their being kept constantly warm, and partly also by their greater proximity to the chief blood-supply than those on the exposed part of the globe. In some cases there is photophobia; this varies in amount at different times in each patient, but generally remains for a very long time attached to the same cases. As far as my observation has gone photophobia generally bears some relation to the former or present existence of corneal ulceration. Probably in some cases constant winking due to photophobia (or more correctly to exalted sensibility of the conjunctiva) causes the ulceration in the first instance. In others an attack of phlyctenular ophthalmia sets up the intolerance of light for the first time. It is maintained in some cases partly by habit; whilst, on the other hand, the act of winking helps to keep up the conjunctival irritability which first gave rise to it.

The chief symptom remaining to be noticed is that of *discharge*. It is not quite so easy as it appears at first sight to prove the complete absence of discharge from the conjunctiva in a large collection of children. If there is any at all, it will be found early in the morning, before the face has been washed. It may either glue the lashes together into little pointed bundles, or if mixed with much tears may flow over the skin of the lower lid and dry into little

¹ Nocturnal attacks and exacerbations. Several interesting facts may be mentioned here. All observers agree in stating that attacks of purulent ophthalmia generally come on during the night, *i. e.* that the earliest symptoms are noticed on waking in the morning. It is also commonly mentioned that cases of acute ophthalmia of all kinds, including relapses, are worse in the morning than at any other time. This extends to the slightest cases and I have often noticed children who showed slight ocular congestion in the morning get quite well during the daytime. Even in health the eyes of many persons are a little "blood-shot" in the morning. The fact has often been used as evidence that contagion generally occurs during the night and through the medium of the air. It does not seem to me of much value for this argument, since the inoculation on this hypothesis must occur during the half hour or hour before the patients go to sleep. It appears much more likely to depend (putting aside cases due to cold wind) on the increased supply of blood which one would suppose must flow to the eyelids when the body is horizontal and the conjunctival vessels relaxed by the warmth following the closure of the lids in sleep. These would be the best conditions for the multiplication of a germ implanted during the previous day. No doubt the morning exacerbation during acute attacks is partly owing also to the irritation caused by pent-up discharge and tears.

white flakes like the dried slime of a fish, or may collect into a little pellet at the inner canthus, or may lie concealed in the form of a string or flake far back between the lower lid and the eyeball. From many careful and repeated observations of slight cases I have no doubt that in a large proportion of those whose palpebral conjunctiva is congested there is a slightly increased secretion of mucus. For practical purposes it does not appear of much consequence whether this mucous discharge proceeds from the hypertrophied tubular glands of the conjunctiva (Müller, Thiry), or from the epithelial cells shed from the general surface; probably it owns both these origins. It is of more importance to notice that it may from various slight causes become opaque and white or yellow from admixture with pus, that this change in quality (which is always accompanied by a slight increase in quantity) often takes place very quickly (in a few hours), and that it may quickly resume its former character and quantity. There is also sometimes increased secretion of tears so that some children's eyes always look "watery." The two kinds of secretion (mucus and tears) are not present in corresponding quantities; in some the discharge is always "watery," in others always "gummy." A great many cases never go beyond the following symptoms:—slight mucous and watery discharge; occasional slight ocular congestion and perhaps a little transient photophobia; constantly more or less congestion of the caruncle and of the larger remote¹ ocular conjunctival vessels. These may coexist with very granular lids. The course of the symptoms and the limits within which they vary, are as a rule remarkably constant in each child; but there is no fixed relation between them as occurring in different children. It is certain that many children with badly granular lids continue for long (probably several years) to show a little discharge, and that this in the same child will repeatedly go through the same changes, becoming at one time slightly purulent for a few days and then again diminishing to a mere trace of translucent mucus, and remaining in that state for weeks. There are others who (if not under treatment) constantly have rather more discharge, so that their lids will be generally glued together in the morning and more or less discharge will collect within the lower lids or at the inner canthi during the day. Beyond these, again, is another group in which the discharge, as a rule, gradually increases soon after treatment is omitted and at length becomes profuse and purulent, accompanied by ocular redness and often by photophobia; here, as in the slightest cases, the symptoms bear no fixed relation to the *degree* of granular disease. Whether the discharge in these two groups of cases is to be looked upon as the normal result of the uninterrupted granular disease, or, on the other hand, as having

¹ *i. e.* remote from the cornea.

originated in a superadded contagion or in some irritation of the conjunctiva, the cases are for clinical purposes distinct from those in which there is never any, except very slight mucous, discharge, and will be best considered under the subject of contagious ophthalmia. It may be mentioned here, however, that the majority of these cases of persistent discharge occur in young children (from three to eight), and that from the constancy of the symptoms in each case it is almost certain that the gradual relapses which occur in them, after treatment has been omitted, are due to the return of that morbid action on the part of the conjunctiva which had been much reduced and kept in check by local applications.

Termination and results of the Granular Disease.—There is much difficulty in ascertaining the proportion of cases in which permanent injury to sight is a result of granular lids, and notwithstanding all that has been written there is, I think, still some misapprehension on the subject. While fully admitting the very serious consequences to sight which result from ulceration of the cornea and pannus in bad cases of granular lids and going so far as to say that a considerable proportion of the opacities met with in children are due directly or indirectly to this disease, I think it is an error to assume that such consequences follow the majority of cases of granular lids. From what has come under my own observation I can have no doubt that the opinions expressed on this subject in various forms by many army surgeons are substantially correct and that most cases of moderate or even tolerably severe granular ophthalmia pass through their stages, recover, with or without scarring, and are not afterwards followed by any harm whatever. No doubt almost all cases of partial and complete pannus and of organic entropion, and some cases of trichiasis and of changes in the position and size of the lachrymal puncta and canaliculi, are the results of granular ophthalmia. So long as the lids, especially the upper lids, are considerably roughened, either by chronically enlarged papillæ alone, or by a mixture of sago-grain and papillary granulations, or by prominent rigid cicatrices, there is always a risk that they may set up ulceration of the corresponding part of the cornea with development of vessels in its superficial layers. Cases of repeated superficial ulceration of the cornea, resulting in numerous facets, are also not uncommonly the result of granular ophthalmia complicated with severe ophthalmia tarsi. There is also the risk that, short of these results, granular disease may bring on prolonged and repeated photophobia of a degree quite enough to interfere with everyday occupations. When all these have been allowed for, however, there will still remain a large proportion in whom no serious results happen during the several years that the children stay in the schools. It is stated that entropion comes on as long as ten or twelve years after chronic granular ophthalmia (Snellen). Without questioning that this may occur in

certain cases, I venture to think that without much qualification such a statement is apt seriously to mislead. I have seen a great many children whose eyelids are extensively scarred by this disease, some of them having certainly (from their history) been in this condition for several years, who suffer no inconvenience and in whom, though I have had them under constant observation for twelve months, not the slightest alteration has occurred in the curvature or position of the lids.

From the very long course of the disease and the erratic habits of patients, it is practically out of the question to follow cases to their termination in civil hospital practice. The same objection applies in a great measure to poor-law schools, where the children are sent out to service when fit and of proper age and it becomes difficult to trace them for more than a short time afterwards. Some of the worst cases come under care again at the ophthalmic hospitals; but then it is not of the worst cases that there is any question. It is in respect to the cases next in order of severity, where there is disease enough to produce permanent change in the structure of the palpebral conjunctiva and subconjunctival tissue and not infrequently to invalid the patient for a long time unless under treatment, but in which the permanent detriment to the cornea is generally either slight or nothing, that the completion of the clinical history is most wanted. Cases of this degree form a very large majority of those who come under the surgeon's hands for ophthalmia in our pauper schools, and probably also in the army. It is likely that the older inmates of workhouses would furnish as fair a field for inquiry on this question as could be found. Among them we should not expect to find many persons to whom the disease had proved extremely serious, for probably in many of these life would be indirectly shortened by the malady while others would obtain provision from various charitable bodies or by pensions. If it were the case, however, that any considerable number of poor persons had once suffered from the disease in tolerable severity but had not received from it any permanently disabling result, we might expect to find a fair sprinkling of them among the ordinary old and "infirm" inmates. A full inquiry of this kind would occupy much more time than has been at my disposal for the purpose, and I therefore give the results of such inquiries at two of the workhouses rather as indicating the direction in which a useful investigation might be made than for the purpose of drawing final conclusions. So far as they go, however, the cases given below confirm the hypothesis that attacks of granular ophthalmia (complicated or not with purulent ophthalmia), severe enough to give rise to considerable scarring of the tissues of the upper lid, are often not followed by any remote ill consequences from the slow contraction of the scar.

The following table shows the remote effect on the curvature of

the eyelids, direction and growth of the eyelashes, and functions of the lachrymal puncta and canaliculi, in twenty-one persons (for the most part forty years old and upwards) whose eyelids showed more or less scarring the result of previous attacks of granular ophthalmia. The inquiries were made at two metropolitan workhouses, from the medical officers of which I received permission to examine the eyelids of every inmate. The method adopted was to ask each person whether he or she had ever had "bad eyes" of any kind. If the answer was "no," and there was no distortion of the eyelashes, epiphora, thickening and redness of the edges of the lids, or discharge, I usually did not evert the upper lids. Whenever, from the answers given or from external signs, a previous attack seemed probable, I always examined the inner surface of the upper lids. In almost every inmate I looked at the inner surface of the lower lids.

Besides the cases tabulated below, which include all in which there was scarring of the palpebral conjunctiva, there were a good many cases of the chronic ophthalmia common in old people, characterised by thickening of the free borders of the lids with or without alterations of the puncta and lashes, sometimes with muco-purulent discharge and chronic thickening of the palpebral conjunctiva, but in no case with scars on the inner surface of the lids. These are not included in the table.

In examining the upper lids for conjunctival scars it is necessary to be aware that the appearance of an incipient linear cicatrix in the typical position already mentioned may be rather closely imitated by the blanching, due to pressure, which often occurs at exactly the same part while the lid is everted. Now and then I have found it almost impossible to be certain whether there was or was not any actual scar, but in the great majority of cases it is only necessary to be aware of the fallacy in order to avoid it.

The number of inmates so examined was about 400 in one workhouse and 450 in the other. The great majority of those examined were more than fifty years old.

No. Sex. Age.	Race.	Scarring of upper lids; extent, &c.	Date of attack.	Present effect on margins of lids and lashes, &c.	State of cornea.
1— F. 68	Irish.	Both upper lids and both lower lids.	"Blight" 15 years ago; never before.	None.	Old nebulæ.
2— F. 87	Irish.	Both upper lids very extensively scarred.	Bad eyes on and off since age of 20.	Slight synechia tarsi; no distortion.	Clear (has cataracts).
3— F. 39	Irish.	Right upper lid scarred, and still somewhat rough.	Eyes bad for first time 19 years ago (at age of 20); never before.	None.	Right somewhat vascular and nebulous; left very nebulous.
4— F. 70	Irish.	Both upper lids slightly scarred, and still some roughness.	Cannot tell; memory bad.	None.	Clear.
5— F. 63	English.	Right upper lid scarred.	Says eyes were never had till 2 years ago; probably incorrect.	None.	Clear.
6— M. 50	Born in London. Parents Irish.	Both upper lids well-marked scars, still some roughness where not scarred; minute scars on lower lids also.	At aet. 10 had had eyes for 2 years in a workhouse-school; got well and earned a good living for self and family. At aet. 35 had second attack and was disabled for 2 months; since then well.	None.	Clear.
7— M. 86	English.	Slight scarring of right upper lid; both upper lids red and thickened by papillary granulations.	"20 years" ago had "sore eyes," on board a man-of-war (probably more than "20 years" ago).	None.	Clear.

S— F. 48	English, but father Irish.	Well-marked scar of left upper lid; right eye lost and shrunken, probably by a violent attack of same disease, but attributed by her to "nitrate of silver," running into it while the inflamed left eye was being treated.	Bad eyes 31 years ago (at æt. 17); were bad on and off till æt. 26; since then no trouble at all.	None.	Left clear.
9— M. 68	English.	Right upper lid slightly but definitely scarred.	51 years ago (æt. 17) inflam- mation of right eye for "6 months" on board ship.	None.	Right cornea slight central haze and a very marked arcus at upper part; left clear, except moderate arcus. Large diffused haze of each, but no vascularity.
10 M. 33	Irish.	Slightly irregular but defi- nite scarring of both upper lids.	Eyes bad about 13 years ago for 3 years, while in New Zealand Army; discharged from Army for defect of sight in consequence. Operation (probably peri- tomy), by Mr. Hutchinson, 8 years ago; eyes as good as now 7 years.	None.	
11 M. 68	Irish.	Well-marked scar of both upper lids; rest of each lid somewhat rough.	Does not know that he ever had bad eyes.	Slight marginal blepharitis; edge of each upper lid a little straightened by short- ening, but no inconvenience.	Clear.
12 M. 60	Irish.	Well-marked scars on both upper lids.	30 years ago (at æt. 30) had bad eyes for "10 weeks."	None.	Slight haze of a narrow seg- ment of upper part of each, but no interference with vision.
13 M. 70	Irish.	Very extensive scarring of both upper lids.	17 years ago had "bad eyes," brought on by getting a "blade of wheat into left eye whilst in the harvest- field;" never before or since.	None.	Left, large leucoma and an- terior synechia from per- forating ulcer; right, slight central haze and probably old iritis.

TABLE—continued.

No. Sex. Age.	Race.	Scarring of upper lid; extent, &c.	Date of attack.	Present effect on margins of lids and lashes, &c.	State of cornea.
14 M. 73	Irish.	Patchy scarring and old granular lids; all the lids intensely congested.	Bad attack 3 years ago, "could not see for 3 months;" was under treatment; eyes liable to "stick" in the morning for about 12 years.	None.	Clear.
15 M. 64	English. Parents Irish.	Very extensive scarring of both upper and both lower lids.	"Blight" 10 years ago, whilst in a workhouse; "15 others" had bad eyes at same time; his eyes were bad for "5 years, and for the last 5 years or so have been as well as now, and free from discharge," says emphatically that he had no treatment of any importance.	None (perhaps slight shortening of the oculo-palpebral part of conjunctiva, but not enough to do any harm).	No note.
16 M. 30	English. Parents Irish.	Left upper lid only has well-marked linear scar in usual place; lower lid nearly normal; right lids normal.	8 years ago inflammation of left eye after getting lime into it.	None.	Large old haze from inner margin to centre.*
17 M. 37	English.	Slight scarring in usual position in both upper lids; much redness and thickening of whole conjunctiva.	7 years ago had inflammation; fresh attack lately.	Slight eversion of edge of each <i>lower</i> lid; bad old syco-sis tarsi and loss of lashes.	Old central haze of each.
18 M. 22	English.+	Superficial reticulated scars of all the lids and in left upper lid a well-marked linear scar in usual position.	Was never in the infirmary for "bad eyes" and does not admit that they ever were bad.	None.	Perfect.

19 F. 41	Irish.	Slight scar on right upper lid in usual position; conjunctiva of all the four lids very red and thick but not granular.	No definite history of inflammation; probably began as syphilitic tarsi, which has spread to the conjunctivæ; left eye "hazy" for "12 years."	Entropion of both upper lids; left the worse.†	Left, a diffused haze.
20 F. 53	English.	Right upper lid extensively scarred all over the tarsus, and scar especially dense in usual position; lower lid also much superficial scarring.	7 years ago both eyes bad for "4 months," right was worse; treated by "caustic" to insides of lids, at Charing Cross Hospital; since then quite well; no relapse.	None.	Extensive arcus, wider at the upper segment, and probably there in part due to former ulceration from granular lids.
21 F. 43	Irish.	Moderate scarring of right upper lid in usual position; still some old pale papillary granulations on both upper lids.	"20 years" ago eyes "weak and watery" for "12 mos.," never very bad.	Edges of lids thick, and lashes a little distorted, but no inconvenience.	Clear.

* The corneal haze here is doubtless due to direct injury by the lime. Probably the scar on the lid being in exactly the position for granular ophthalmia is due to that disease, greatly aggravated and made active by the lime injury.

† Brought up in a London workhouse-school from æt. 2 to 16. Always weakly. Now phthisis. Memory good; remembers correctly some details about the school. May have had a bad attack when very young, but if so it would probably have lasted long enough for him to remember something about it. Probably a case of pure uncomplicated granular ophthalmia of considerable severity which never produced subjective symptoms.

‡ The entropion is worse in the lid which shows no scar.

In granular ophthalmia, more than in many other diseases, it is necessary to be very cautious in giving a prognosis from a single examination of the patient. The relation between the organic changes and the symptoms is so variable in different persons that a mere view of the conjunctiva, however careful and minute, will form a very incomplete basis for an opinion of the patient's future prospects. The following points will be of much service:—1. The approximate duration of the disease, if it can be ascertained; the future risk of serious symptoms or secondary structural changes will be small in proportion to the length of time that has already elapsed without them. 2. The present existence of subjective symptoms; these, if present, damage the prognosis, since the liability to them (*cat. par.*) becomes greater after they have once appeared than it was before their first occurrence. 3. The same rule applies to corneal opacities and ulcerations; a large majority of ulcerations occur as relapses in patients who have already suffered from them. 4. The presence of ophthalmia tarsi (sycosis tarsi) in addition to granular conjunctiva increases the risk of corneal ulceration, as well as the liability to alterations in the curvature, &c., of the lids and lacrymal puncta.

Causes of granular ophthalmia.—Although this disease has long been known and more or less perfectly described, no great care seems to have been bestowed on its etiology until it began to be recognised as forming a very important element in the epidemic ophthalmia which has occurred in most of the European armies since the year 1800, and which has been a serious disease in Egypt and some other hot countries for centuries.

Granular disease, as distinguished from contagious ophthalmia, was well described as a prevalent one among large collections of men by O'Halloran, in 1824. In speaking of the common error of comparing the "granulations" of this disease to those of an ulcerated surface, he says, ". . . we see in the eyelids of persons who never suffered from the disease (*i. e.* purulent ophthalmia) an appearance similar to what is commonly designated 'granular.'" He goes on to say that this may be verified in "any body of men, viz. a military corps or regiment." And again, "In every large body of men persons are to be found whose eyelids are overspread with villous floeculencies, or fungous productions analogous to what has been denominated 'granulations,' notwithstanding that from youth they may have enjoyed health or absolute immunity from the affection under notice." After describing with some accuracy the chief varieties in the appearance of granular lids, he has the following passage as to the nature of the disease. The granulations are "simply enlargements of a fungous nature from the glands and vessels; the former, if I mistake not, being far more numerous than has been supposed;¹ that similar enlargements take place in serofu-

¹ He does not seem to know that J. B. Müller had, in 1821, concluded that con-

lous habits where the glands in other parts are diseased; that in such cases the affection of the glands of the eyelids is sometimes the cause, and not the effect, of what is called inflammation." The full importance of follicular or "vesicular" granulations as predisposing to severe attacks of conjunctivitis was not pointed out till some years later. They were accurately figured by Eble in 1828¹ and described by him as forming the first stage of contagious ophthalmia, and in 1839 Hairion gave them an important position in the disease. The fact, now universally admitted, that they especially predispose to attacks of severe ophthalmia, was observed by Loëffler in 1848, and has since then been abundantly confirmed.

The gradual discovery of the important rôle played by these granulations in the destructive ophthalmia of European armies led to the assumption in the first place that they, as forming one of the symptoms or results of the so-called Egyptian ophthalmia, had been imported into Europe from that country about 1800. When it was at length discovered that they are not the result of purulent or other acute forms of conjunctivitis it was asserted by many authors that two distinct diseases of the conjunctiva had been imported into Europe from Egypt—the vesicular granulation, or "vesicular exanthem of the conjunctiva," and purulent ophthalmia. With regard to various forms of acute conjunctivitis, it was allowed that they had been known to occur both sporadically and epidemically in Europe long before the Anglo-French Egyptian campaign; but it was contended that granular ophthalmia proper, not having been described as a prevalent disease, could not have existed in Europe (or at most only sporadically) until introduced from Egypt, and that, in fact, it had been so introduced. Inasmuch as the true nature and importance of vesicular granulations was not discovered until long after the alleged importation of the disease from Egypt, it was thought by some that descriptions of similar appearances by early authors could not safely be taken as referring to the disease in question. Further, it was held that the negative fact of these granulations not having been noticed by modern observers in a given country until the occurrence of severe ophthalmia in the army or civil population of that country drew attention to the subject, was equivalent to proof that they had no existence until they were seen. That granular ophthalmia was introduced from a distant part and afterwards spread very widely among the military and civil populations of almost every European country, necessitated the doctrine of contagion, and we accordingly find that several authors adopted, with some modifications, Thiry's hypothesis of a special

tagious ophthalmia was "a disease of the mucons glands of the eyelids." Congrès d'Ophthalmologie, 1857, 'Compte-Rendu,' p. 291. I have not yet been able to examine the treatise of 1821 here referred to.

¹ These are the best illustrations I have seen.

“granulous virus.” This was supposed to be generated in the vesicular granulations and thence to escape into the air in a “gaseous state” after their rupture (Landau), and to propagate itself both by direct aerial infection and by contaminating bedding, clothes, &c., from which it might again be given off in an active state after as long a period as three years (Hairion). It was further asserted that the disease never originated *de novo* in Europe, its origin in this way being confined to Egypt, and, perhaps, some other hot climates. To this a few authors added the still more startling proposition that it was a constitutional blood-disease.

Many writers have now abandoned the theory that contagion is the cause of follicular granulations. The expressions in most of the text-books are now to the effect that granular ophthalmia is contagious when accompanied by and in proportion to the amount and purulence of the discharge.

Although evidence that granular ophthalmia existed in Europe before the date referred to would not weaken the hypothesis that it is contagious, this would be the effect of evidence showing that other more probable hypotheses would account for the facts equally well without recourse being had to a supposition which is quite without parallel in pathology.¹

It is difficult to understand how the evidence that this disease was present in Europe prior to 1800 can have been disallowed by any one. Many authors have asserted it and quoted early writers in support of their opinions, among the most recent of these being Welch in his very able and valuable paper in 1869. As there is still some want of conviction on the subject however, it may not be amiss to repeat some of the best known evidence, much of which has been quoted in a more or less scattered form by various authors.

The accurate description of the various kinds of trachoma given by Aetius, including an account of one kind which can refer to no other disease than vesicular granulations, I omit, as it is probable that his experience was drawn largely from oriental countries where, as in Egypt, it is admitted by most authors that the disease has existed for centuries. Scheffer's brief description (1678) of an ophthalmia in Lapland can scarcely refer to any other disease, since it may be safely asserted that granular ophthalmia is an essential part of any permanently endemic eye disease which destroys or seriously injures the sight of a large number of persons in a given

¹ The hypothesis (unconfirmed by demonstration, as in ringworm, &c.) is that a contagium is given off by a very small part of the mucous surface of the body in a state of extremely chronic and purely local disease, of so volatile, active and long-lived a nature as to be capable of infecting the great majority of those exposed to it, and of being transmitted, after long preservation, through the medium of infected objects.

country or locality. He says, "Diseases of the eyes, which they inherit in an inflamed, watery and bleary condition, is their commonest malady, and is very often followed by loss of sight. The smoke with which their cabins are always full, summer and winter, and the light of the fire, in the front of which they sit all their lives, cause this disease." The next instance, occurring in Ireland, though more detailed and circumstantial, may be objected to on the ground that a mere acute purulent ophthalmia would have caused the same results. This is, however (as in the case above quoted), so unlikely in a civil population living under their ordinary conditions, that it may be put aside. It was doubtless an epidemic of purulent ophthalmia in persons who were already the subjects of granular disease. The instance referred to is mentioned as follows by Mr. (now Sir) W. R. Wilde:—"So long ago as 1701 an epidemic of this nature (*i. e.* destructive ophthalmia) broke out near Castle-town-delvin, in the county of Westmeath, by which vast numbers lost their eyesight." It is much to be regretted that the original manuscript by Sir Thos. Molyneux should not have been published under Mr. Wilde's direction; it is entitled, 'Queries proposed by Dr. T. Molyneux to John Hill, curate of Castle-town-delvin, in the county of Westmeath, concerning the extraordinary distemper that took away the sight of many in that parish.' It occurred, like many subsequent epidemics, during a time of general distress in Ireland, during which many thousand woollen manufacturers had to emigrate for want of employment, and "the whole kingdom was reduced to the greatest poverty and distress." Sir Wm. Read was evidently acquainted (about 1710) with various kinds of granular lids, including primitive vesicular granulations, eyes so affected, showing "an inequality and roughness of both the eyelids in their inward part, with an hard ruggedness, as if the seeds of millet were within them." The last comparison would be still more valuable if it were not identical with that used by Aetius. Maitre-Jean, in 1740, described granulations on the lids; and a year later St. Yves, writing on 'Tetter of the Eyelids,' says, "if the *eyelids* be turned out they appear red in their *inside*, and seem to have *inequalities* somewhat like the *small grains* of figs."¹ In his inaugural dissertation (1751) Koenigsdoeffer describes soft, yielding, but solid, prominent "tubercles" on the inner surface of the eyelids. He adds, in order to distinguish them from the villous lid and the harder granular lid of Aetius, that in the disease he was describing "there was no roughness of the lids." He gives (p. 10) a case of general scrofula in which the eyes had been inflamed for two years, and "the morbid matter of the disease having gone to the eye, had not only affected the Meibomian glands but had raised tubercles on the inner mem-

¹ The word "sycosis" was used by the very early writers to designate advanced and prominent granulations on the conjunctiva.

brane of the eyelids, which appeared to increase the inflammation of both eyes excessively." The glands in the palpebral conjunctiva (which he carefully distinguishes from the Meibomian glands), are, he says, more easily seen in the lower animals than in men, are found all over the upper lid and on a part of the lower lid, "consist of very close and minute lenticular particles, varying in size and shape," and they "secrete serous and not sebaceous matter." It is extremely probable that granular disease existed among the horses of Ireland more than a century ago. In the winter of 1750-51 there was in Ireland "a universal catarrhal fever among horses;" "and many of the labouring horses who had this disorder suffered so much in their eyes as to have become blind." The same thing occurred again in 1760, and, writing two years later, Rutty says it was computed that one horse in every ten affected had been permanently blinded. Lymphatic follicles are known to exist in the normal conjunctiva of the horse. The 'Trachoma herpeticum' of Plenck (1783) clearly refers to vesicular granulations.

The above extracts appear to show that granular ophthalmia in all stages and varieties was well known in several widely separated European countries between one and two hundred years ago, and that consequently it does not own an Egyptian origin. Whether it was relatively as common then as now it is impossible to say, but it would probably not be so if the best supported theories of its cause are true. The negative fact that it was not known to be prevalent is of no value considering the state of medical knowledge at that time. Nor can I attach any great importance to assertions that it was unknown in Strasburg till 1851 (Stoeber), in Belgium till 1814 (Hairion), in Algeria till 1859 (Hairion, Furnari), in Denmark till 1848-51 (Bendz), in Russia till 1816 (Kabath), &c. We are nowhere told that vesicular granulations had been carefully looked for and found absent, but only that they had not been observed until a severe outbreak of contagious ophthalmia drew attention to the state of the conjunctiva in those who were supposed to be healthy. In the case of Algeria, moreover, statements differ, and even the same author gives evidence in one part of his works which is inconsistent with assertions in another. Thus Furnari, while denying its existence in Algeria in 1859, describes sequelæ of ophthalmia (granulations, pannus, entropion) in that country in 1844 which leave little doubt that the true granular disease was at the latter date far from rare. Cuignet, in his recent book, maintains the identity of Algerian and Egyptian ophthalmia and believes that it was well known in Algeria long before the French conquest, which was, according to Hairion and Furnari, indirectly the means of its introduction into that country by way of Europe.

With respect to the contagious character of granular ophthalmia

there are various shades of opinion. Some observers hold that not only are follicular granulations caused by contagion and in no other way, but that the contagium is not of necessity associated with any perceptible conjunctival discharge, is given off by the simple sago-grain granulations, becomes volatilised and acts at a distance, and may have a long period of latency in the conjunctiva. To this a few add that the virus may be absorbed by the pulmonary mucous membrane as well as by the conjunctiva, and that the disease is a constitutional one. Others, who do not go to this length, believe that though the granulations are caused by contagion, the contagium does not exist or cannot act unless there is conjunctival discharge, and that this is indistinguishable from the product of an ordinary conjunctivitis (*i.e.* inflammation of a non-granular conjunctiva), except by its specific power of reproducing vesicular granulations. According to a third school, contagion is only one out of several causes of granular disease, and also requires purulent or mucopurulent discharge as its condition of action. A fourth group maintains that contagion has no part in the matter, that follicular granulations are due to various faults in the conditions of life and will always be reproduced when those conditions are allowed to come into play. De Condé and Schmidt, in 1841, held that granular ophthalmia should be compared to typhus in being a blood disease of which one attack was protective against a second, and attempted without much success to support this position by statistical and clinical evidence intended to show an antagonism between this disease and typhus, dysentery and intermittent fever. Many others, such as Müller, Bendz and Hairion,¹ held that it was a local specific disease propagated by aerial infection, with a period of latency during which the granulations, though invisible to the naked eye, might sometimes be detected by a lens and were at any rate liable to grow and become active on very slight provocation; and that "it is transmitted without the conjunctiva being the seat of any visible morbid secretion, solely by contagion, and generally by miasmatic means" (Bendz), by the agency of a special "granulous" or "vesicular virus." Marston and Frank, though they do not express themselves in so unreserved a manner, appear to hold very much the same opinion, as also do the French editors of Mackenzie's treatise. Thiry may be taken as the leading exponent of the second school. According to him the "granulous virus" is the product of a peculiar, though acute and virulent, inflammatory process, and has for its result the formation of granulations and reproduction of the same specific purulent discharge. He considers that true granular ophthalmia is the result of an acute process, and does not admit "vesicular" and "fleshy" chronic granulations within the pale of

¹ Dr. Hairion was still of the same opinion in 1873.

the true disease. Wecker represents the third school when he states that granulations are contagious because of the purulent secretion accompanying them and in proportion as this approaches the characters of pure pus, while granulations unaccompanied by discharge are but rarely contagious. An almost identical opinion is expressed by Stellwag, and other recent writers appear to take nearly the same view. The ordinary cause of chronic granulations Wecker places in prolonged exposure to air rendered impure by overcrowding, though he does not specify which constituent, if any in particular, of this impurity is the actual cause. Soelberg Wells is still rather ambiguous, and "has little doubt that vesicular granulations are contagious," with the qualification that this is especially true when they are accompanied by swelling of the conjunctiva and by a little muco-purulent discharge. Overcrowding and prolonged exposure to impure air, to which some add exposure to smoke and the exhalations of domestic animals, are mentioned as the cause, with more or less clearness, by Rust, Scheffer and many other early authors, and more recently by Anagnostakis (1857) and Schweigger (1870), and by many of the authors who believe that contagion is in part a cause. The view that contagion plays no part at all in the causation of follicular granulations was more distinctly put forward by Welch in 1863 and again in 1869. He concludes against contagion on account of the almost invariable symmetry of the disease and because it does not spread among a body of men in any relation to the facilities for direct contact. The argument from symmetry would be worse than worthless if directed against infection through the air at a distance or by fomites, but is of some value as against direct contagion. The second reason is a very potent one. He gives much evidence in favour of the intimate relation between nocturnal impurity of air in dormitories and the appearance of vesicular granulations, and thinks it probable that living habitually in an atmosphere contaminated by organic matter (not, as he is careful to say, epithelial or pus-cells) is the actual cause, but that warmth and moisture of the air are essential conditions of its action. Dr. Leith Adams also concludes in favour of crowding and bad ventilation, and mentions habitually impure air in bed-rooms as a possible cause of the disease among persons living under apparently good hygienic conditions. Brudenell Carter suggests that the decomposing organic matter contained in fustian may have something to do with the greater prevalence of the disease among the boys than the girls in schools. Many firm contagionists are also believers in the great importance of anti-hygienic conditions, especially Marston, whose conclusion "that the state of the conjunctiva offers a delicate test of the hygienic state of a regiment" has almost passed into a formula.

Welch's hypothesis, supported as it is by many careful observa-

tions, that excessive moisture of the air is essential for the production of vesicular granulations, if it be not the cause itself, appears to me a very important one, more especially as it bears out the opinion so very often expressed by authors, that moisture is one cause and an important one, of various forms of epidemic ophthalmia. I shall therefore go somewhat into detail in the quotation of opinions and facts bearing on this subject, keeping to such as refer to or at least include in their account granular ophthalmia, as well as the forms of conjunctivitis proper.

One or two negative facts may be conveniently mentioned first. Such negative evidence is not altogether free from fallacy, since in a country where the soil and air are generally very dry the population is almost sure to be thin, and thus there will be an absence of other probable causes besides damp. In Egypt, Power and Anagnostakis tell us that the Arabs of the Desert parts, "where the heat is intense but the air very dry," do not suffer from ophthalmia; and Burton says the same with respect to the inhabitants of Western Arabia. "Every one knows," he says, "that ophthalmia is unknown in the Desert, and the people of El Hajez, who live in an atmosphere of blaze and sand, seldom lose their sight." Ophthalmia is well known to be very common and severe in Algeria, but Lustreman tells us that the inhabitants of the mountains and sandy plains of that country are free from it.

The evidence as to the effect of moisture (both of air and soil) may be divided into two parts. First, there are the general facts as to the prevalence of the disease in countries which are habitually moist and in damp districts or towns in otherwise dry countries; and secondly, some more precise statements as to the observed effects of moist or dry climates or localities on the conjunctiva of persons living there. The second part is more scanty, and perhaps not always so reliable as the first. Evidence of the first kind is of course not free from fallacies; nor do I wish to attempt anything like a complete exposition of all the facts that might be collected but only to mention some well-marked instances pointing in this direction. The two most important fallacies are, that the largest and most crowded cities are usually built on low and more or less damp sites, and that acute catarrhal forms of conjunctivitis are also extremely common in damp changeable climates and sites, so that it is often impossible to distinguish, from a written account, how much of a prevalent ophthalmia is due to them and how much to granular disease.

A very striking instance of a habitually damp country where granular ophthalmia is known to be very prevalent is Ireland. It is far commoner among the Irish than either English or Scotch, so much so that the tendency to it is not only permanent in natives of Ireland wherever they live, but is to a great extent hereditary, the

children of Irish parents being much more subject to it than those of some other races, even though they do not live in Ireland.¹ Egypt furnishes another equally prominent and instructive instance, although less simple, the element of moisture being there combined with other agencies which are more or less prejudicial to the conjunctiva, especially dust and intense light and heat. It is the case, however, that in Egypt ophthalmia (of which the granular disease is as important an element as in the ophthalmia of Ireland) is most abundant in the dampest parts of the country. According to Dewar and Power almost the only parts of Egypt which remain wet all the year round are at and near the rice-grounds; and the latter author tells us that "those employed in the cultivation of rice are peculiarly affected with blindness." The soldiers of the French Army suffered less from the disease in Upper Egypt in the dry season than those in Lower Egypt (Dewar). The "warm and moist climate of Egypt" is considered by Landau to be the birth-place of the "vesiculous virus." According to Anagnostakis the atmosphere of Lower Egypt during the flood period of the Nile is extremely damp, and in Alexandria, he says, this dampness prevails from the end of spring till November.² Scoresby Jackson makes statements of a similar general character with respect to the atmosphere of Lower Egypt, and especially of Alexandria, as compared with that of Middle and Upper Egypt. In Algeria "low and damp country" is specified by Cuignet as one of the most powerful predisposing causes of ophthalmia. Furnari describes the dwellings of some of the Arabs in Algeria as "swimming in mud" in the winter. Laveran says that purulent ophthalmia in this country affects particularly the "planters of the low unhealthy villages, the Arabs of the towns, and especially the inhabitants of the oases crowded together in infected huts built on a wet soil under the palm trees." According to Lustreman those Arabs of Algeria "who live in the damp coast stations, or in huts surrounded by water in the oases, show all the ocular changes which have gained for Cairo the title of the city of the blind." In Malta, where granular ophthalmia has since the beginning of this century (and probably long before) been very prevalent, Hennen says that the air in autumn is excessively moist and hot, and that the island is by no means free from marshy districts, between two of which Valetta is situated. Suez, where ophthalmia is sometimes very destructive, is also subject to inter-

¹ I first learnt these facts from Mr. Hutchinson.

² The Nile begins to overflow its banks in Egypt about two months after the summer solstice, *i.e.* about the end of the third week in August. The inundation continues for two or three months, more or less, and its bad effects have ceased by the end of November.—'Encyclop. Brit.,' Article "Egypt." Scoresby Jackson, 'Medical Climatology.'

mittent fevers and is situated on or close to a large swampy surface of seashore which is left bare at certain seasons. Florio is emphatic on the efficacy of damp air and buildings as one of the most important causes of the disease. The coincidence of prevalent and prolonged ophthalmia among soldiers with an especially marshy and foggy site on the plain of Marengo, where intermittents and dysentery were common, is mentioned by Carron du Villards.

Of more precise statements we have the recent and valuable observations of Welch to the effect that in a given regiment, while living at Malta in barracks where a high rate of aerial moisture was, among other bad conditions, pretty constant, follicular granulations increased vastly; although even here they varied at different times according to the quality of the barracks occupied and were, as a rule, worst in those "companies" which occupied the worst ventilated and dampest quarters. When the same men were moved to New Brunswick where, among other things, the air was on the average much drier than at Malta, the disease receded in those previously affected and did not occur in any who had been free from it in Malta. The same was the case also with a number of men who were sent from the home *dépôt* to join the regiment in New Brunswick; their lids, which on their arrival in Canada showed nearly half to be affected, very much improved while there. The first recorded severe outbreak of ophthalmia in Portugal was in a large school of several hundred boys and girls who lived in a dark and damp underground building. Dr. Massy in 1851, says of Athlone (in county Westmeath, Ireland), that "the atmosphere is perhaps the dampest that I have ever experienced, except, perhaps, in India, during the rains;" that it "is well known as a locality where ophthalmia constantly prevails," and that almost every regiment quartered there suffers from it. The 31st Regiment, of which he is writing, had suffered slightly from the disease before being quartered at Athlone in 1848, but after being there nearly twelve months the disease became much more prevalent among the men, and during the next year some very severe cases occurred. Hennen gives interesting details as to the effect, in Malta, of moist air in aggravating half-cured cases of military ophthalmia. In 1807 Mr. Vetch drew up a special report on the effect of moisture on ophthalmia, in which he gives many interesting details of the bad influence of damp localities and foggy wet weather on cases of military ophthalmia in Kent, and the benefit of drier situations and dry weather in favouring the recovery both of chronic and recent cases. In his opinion the hottest weather is best for convalescents, *if clear and sunny*. He thinks the greater moisture of England accounts for the disease having been more violent and destructive in the Army in this country than at Gibraltar, and, as he thinks, even than in Egypt.

In the case of the Metropolitan pauper schools, it is worth while to remember that their inmates have in the majority of cases not only lived in much overcrowded houses, but are also natives of the Thames valley. It is true that several of the schools which have suffered most from the disease are situated on a level much above the Thames, but there may be other facts which would diminish the value of this objection. It is not impossible that a difference of climatic aerial moisture may have some share in the absence of troublesome ophthalmia from many pauper schools in the country districts. Excess of moisture is, under ordinary conditions, a constant constituent of air rendered impure by animal respiration, so that it is quite possible for persons who spend a large part of their lives in ill-ventilated rooms to be thus exposed to the effects of moist air, even though the climate of the country or district may be dry. It would be worth inquiring whether persons (especially children) who work in hot, dry rooms where the air is not often changed,¹ show a smaller average of follicular granulations than others living in the same place but employed in other ways.

Whether the essential cause of follicular hypertrophy be moisture, either of air or soil or both, or some form of organic matter as Dr. Welch and many others suppose more likely, there can I think, be little doubt that moisture is an important condition in the development of the disease, and that in all probability it would be practically exterminated if the air habitually breathed could be kept dry enough.

It is of practical importance, even at the present time to determine whether pure granular ophthalmia is contagious or not, and to my mind the evidence is quite conclusive against this view. All the known facts go to prove that, whatever may be the cause, lengthened exposure to it is requisite (probably of many months). Welch thinks twelve months necessary. Massy's statement as to soldiers getting ophthalmia after nearly a year's residence at Athlone, though less definite, would appear likely to point to the same fact. Wecker thinks exposure for a *long time* to air made impure by overcrowding is one cause of chronic granular ophthalmia (he however, like Müller and especially Thiry, attempts to draw a distinction between granulations proper to contagious ophthalmia, and those elevations or "vesicular granulations" due to simple hypertrophy of the normal lymphatic follicles and mucous glands of the conjunctiva, a distinction quite impossible in practice, as he afterwards, in fact, admits). Gulz specifies "about one year" of exposure to great "overcrowding only" as necessary in order to cause granulations in a number of robust Austrian countrymen previously free from them. Gradman, with less precision, gives two months of garrison

¹ I am told that such conditions can be found in cotton factories.

life in Denmark as generally giving rise to the early stage of the disease in about half the men. I am aware that some authors (especially Hairion) give instances in which a short exposure of healthy men to supposed sources of contagion, either by other men or by fomites, has caused the disease. The value of such observations is, however, much diminished by two facts. Most authors (Hairion prominently) believe that the disease may be latent for a certain time, during which it cannot be detected, or, at least, only with the aid of a lens; it is most unlikely that such a lengthened and elaborate inspection could be made in the case of any large body of men at one time, and so some men with "latent granulations" might easily escape detection. Secondly, any one who has examined a large number of persons for early granulations must, I think, have been puzzled sometimes to know whether on a given conjunctiva there were granulations or not, and it is no reproach to the care or skill of the observer to say that very slight cases (and it is to such only that the present observations of the contagionists refer) may be passed as healthy one day and as diseased a few days later, without any material change having occurred in the interval.¹

If granular ophthalmia, while free from muco-purulent discharge, were contagious at all, it must be so by means of a very volatile and yet very powerful *contagium*, since so many of those who live permanently together suffer from it. But if the *materies morbi* were of this subtle and volatile nature, it would be most unlikely that other persons who, though not living with the diseased ones, come into frequent and prolonged relations with them, would escape. We are told, however, that military officers are seldom affected by the disease though they are known to suffer from the (hypothetically) much less contagious purulent ophthalmia. From the nature of the case it is, however, impossible in the present state of knowledge, to look upon the hypothesis of contagion as absolutely disproved; indeed, the virus is supposed to be so subtle, so powerful and so longlived, that it would be extremely difficult to

¹ The chief difficulties in examining the lower lids for granulations are found in thoroughly exposing the oculo-palpebral fold of the lower lid, and in the congestion which comes on almost immediately after the lid is everted. Without exposing the oculo-palpebral fold at the outer part of the lower lid it is impossible to be certain that there are no follicular granulations, since they almost always begin in this part. If the patient will not look up enough to bring the part well into view when the lid is drawn down, or if from prominence of the orbital rim or tightness of the skin no effort will suffice, slight pressure on the eyeball through the upper lid will generally be successful in making the fold start forwards. The second difficulty can only be partially avoided even by practice in quick observation and gentle handling; when every care is taken it often happens (as Frank has observed) that the congestion obscures even very obvious granulations (they almost disappear as one looks at them), and renders the detection of incipient ones very difficult.

devise experiments showing the spontaneous production of the disease which would not be rejected as fallacious by a thorough-going contagionist such as Dr. Hairion. It can only be shown to be extremely unlikely.

Among predisposing causes the general health of the children will have an influence on the development of sago-grains. Allowance must also be made for inherited tendency to the disease in children of Irish race (and, according to Scheffer and Burton, for those of Lap and Egyptian parentage respectively), and for original differences of tissue, by which, indeed, inherited tendency is probably expressed. The proportion of Irish or half Irish children is probably much larger in the Metropolitan pauper schools than in those of any other part of this country (with a few well-marked exceptions, such as Liverpool, perhaps). This, no doubt, contributes to the frequency of the disease in the London schools. Some of the worst cases of pure granular conjunctiva that I have seen in children have been in those who had thick, fleshy, red lips, thick skin with abundant subcutaneous areolar tissue, and coarse, straight, dark hair. Thick fleshy lips, I think, more frequently accompany it than the thick skin and coarse hair. Then the tendency to inflammation of the eyelash follicles and Meibomian glands, which often precedes severe forms of granular lid with great papillary hypertrophy of the tarsal part of the conjunctiva and considerable corneal damage, often runs in families, the special details of each case being almost exactly the same in several brothers and sisters. I have several times noticed that children whose skin is fine in texture, thin and fair, and whose hair is generally sandy or red, show thin conjunctivæ without any great development of sago-grains. These differences in disease no doubt correspond to similar variations in health. Welch has noticed that men with fair hair and ruddy skin sometimes have less than the normal vascularity of conjunctiva. I have several times noticed the same thing in healthy children, but am inclined to think it is generally seen in those whose skin is thin, who have little cellulo-adipose tissue, and *bright* coloured hair. Very fair hair, or light hair of a dull tint with thick lips and perhaps "fleshy" skin, not uncommonly accompanies bad granular disease with considerable implication of the tissues at the edge of the lid (sycosis tarsi).



The present distribution of Granular Ophthalmia in London and some other parts of England.

My attention was first closely directed to this disease as a very prevalent one among the children in some of our poor-law schools when I was appointed to take charge of the ophthalmic cases from the Anerley school. Since that time I have taken such opportunities as have occurred of inspecting the eyelids of children in these and in other schools, and at the South London Ophthalmic Hospital. These observations have disclosed some facts which, although familiar to the medical officers of some of the poor-law schools and the army, are I believe not so generally known in this country as is desirable.

Before mentioning any details a few words are necessary as to the standard of health to be adopted, or the line within which variations in the appearance of the conjunctiva are to be looked upon as physiological. There appears to be considerable doubt about this among those who have had the best opportunities of judging. For example, such observers as Thiry and Müller would certainly pass all cases of simple vesicular granulations, even if they had advanced to congestion and some implication of the papillæ, as either normal variations due to differences of original structure or as transient changes caused by slight irritations. Others, *e. g.* Wecker, while taking a similar view on theoretical grounds and refusing to allow that the enlarged normal follicles are the starting-point of "true granulations," do for *practical* purposes join those who assert that enlarged follicles are identical with vesicular granulations. Thus he admits that the former "singularly predispose" to the development of acute granulations, and, together with all the best observers, advises a strict watch to be kept on this condition of hypertrophy.

On *à priori* grounds we cannot doubt that the conjunctiva, like every other structure, must show, in different individuals and at different times in the same person, some degree of variation in each and all of its normal constituents. Since both lymph-follicles and lymphatics, and tubular mucous glands form parts of the healthy conjunctiva, we may be certain that they will each present such differences. The difficulty is simply the practical one of drawing the line between physiological excess and incipient disease. The word "disease" itself may perhaps in this case have to be used in a relative sense, for it is possible that a variation of the lymph-follicles, and perhaps other parts of the conjunctiva, which might fairly be considered healthy under some circumstances would have to be looked upon as morbid under other conditions, as *e. g.* when large numbers are living together. It will probably be allowed that asymmetry in the degree of an observed variation is strongly

in favour of its being morbid. It is well known that, although follicular granulations are almost always symmetrical, they are not by any means always equal in degree on the two sides. This is a great help when it occurs, but when the symmetry is perfect I confess I can see no *clinical* ground for calling a conjunctiva healthy in which any such granulations are distinctly visible. It is impossible clinically, so far as I know, to say whether such granulations are enlarged mucous glands or enlarged lymph-follicles. Nor should I be inclined to take the transient character, or at least changeableness in size sometimes shown by early follicular granulations as a safe guide to their being only physiological variations; because it is most likely that if, in a given person, the follicles were subject to frequent and extreme physiological changes they would be unusually amenable to the action of any cause of disease. It would be a great help towards fixing a normal standard if the opportunity could be had of inspecting the eyelids of children of the upper classes, *e.g.* at some of the higher class boys' and girls' schools; indeed, until this can be done, and done by some one who has similar opportunities among the lower classes, I see no probability of reaching a firm basis. There are moreover some cases which for practical purposes ought to be regarded as having follicular granulations, although these may not be distinctly visible to the naked eye. These are mentioned, generally as cases of "latent granulations," by many authors who have had abundant opportunities of observation (Stromeyer, Bendz, Müller, Hairion). I have seen a few such instances myself and have no doubt that they are tolerably common. In those that have come under my notice there had generally been a rather excessive redness of the whole membrane (but no symptoms or discharge) for a long time before the granulations appeared, showing probably a high functional activity of every part. The clinical features of such a case are a sudden attack in one or both eyes (generally in one a day or two before the other) of acute conjunctivitis, and the appearance of well-marked and abundant sago-grain granulations in a very short time, perhaps within twenty-four hours. Papillary congestion and a varying amount of muco-purulent discharge will also occur and the case will present no peculiar features in the early stage unless the palpebral conjunctiva be examined. In duration and liability to relapse it will however differ much from a similar conjunctivitis in which there are no granulations. Occasionally, when such an attack occurs in only one eye, the minute vesicular granulations (or lymphatic follicles) may be seen on the conjunctiva of the unaffected eye by the aid of a lens, or may be just visible without its help if looked for with great care. Whatever name is given to such cases, whether they are called "latent granulations," or whether it would not be better to include them under the head of persons whose conjunctival lymph-

follicles were in the first instance much developed and became actively diseased on the supervention of a special exciting cause, we must acknowledge their importance and keep a careful watch for their occurrence. In inspecting a large number of poor children a considerable proportion will always be found in whom the conjunctiva of the lower lid is more or less congested and gives the impression of having slight papillary hypertrophy. The membrane may be of a bright tint, but it is oftener of a somewhat dull red or pink hue. In many, perhaps most of them, a few sago-grains can be found on very careful search, but these may be very difficult to find, or if present may be quite hidden. Many of these cases I have been accustomed to pass as healthy although I doubt whether, if judged by the highest attainable standard, they ought to be so regarded.

In the school with which I was connected there were, when I first knew it, about 850 children, of whom about 1 in every 9 or 10 had eyelids which were healthy or nearly so. In from 50 to 60 per cent. of the whole number there were well-marked sago-grains, but without any, or with only a slight, degree of congestion; this number included some in whom the lids were scarred and pale and the disease quite cured. The remainder, about 30 per cent., showed either a more advanced condition of granular disease with or without mucopurulent discharge, or discharge with a slighter form of the granular condition. I do not know to what extent other metropolitan pauper schools resemble the above condition, but as to the general character of the ophthalmic cases under treatment in some of them I know, from personal inspection during the last twelve months, that these were very much like those that I had under my care from Anerley; and in two of them, where I had the opportunity of looking at some of the children who were not in the infirmary, there were evidently a good many with various degrees of granular ophthalmia, as at Anerley.

Dr. Bridges states that he has "never yet found any pauper school absolutely free" from mixed granular and mucopurulent ophthalmia. It seems highly probable therefore, that an examination of all the children in these schools would show a slight degree of granular disease in a large proportion of the total inmates. As to the children and adolescents of the London poorer classes living at their own homes I have, since my attention has been specially directed to the subject, found abundant sago-grain granulations in a large number of those who have been under my care as hospital out-patients. Many of these are in persons who apply on account of some degree of conjunctivitis, but many are in those who attend for other reasons and some who only come as companions with other patients. A fair proportion of these sago-grain cases are in children who are socially several degrees above the poorest

class, their parents being better-class artisans, small trades-people, or clerks; they are children who, as is evident from their dress and general appearance, are pretty comfortably off as regards food, clothing and cleanliness. It is true that so far as I have yet seen, the disease is on the average, less advanced than it was in the majority of the Anerley children. Some of these out-of-door cases, even in well-to-do children who have never been in a workhouse, are however very bad. Dr. Littlejohn, the medical officer of the City of London School, "who has kept careful records of the state of every child upon admission, reports that a very large proportion come into the school with the 'sago-grain' condition well marked, and this whether they have been in the school previously or not" (Bridges).

I have quite lately examined the eyelids of about 350 poor school-children in different parts of a country district in a midland county. The following facts are of interest. Two of these were pauper schools. One of them (which I will call *A*) contained 26 children, of whom 42·3 per cent. had more or less sago-grain granulations. The three children in this school whose lids were most perfectly healthy had been in the workhouse only a few days. The workhouse of which this school forms a part is very healthily situated in an open field, on the top of a hill 800 feet above the sea-level, on a limestone (oolitic) soil. The children were well nourished and on the whole looked healthy. The second school, *B*, was separate from its workhouse. Of its 60 children, 61·6 per cent. had sago-grains on their lower lids. Among the 14 worst of these, 12 had been in the school at least one year, the great majority more than two years. Of the 31 healthy children, 22 had been in the school one year or more. These children are all natives of a large town on the Thames; the school itself is three miles from the river, about 100 feet above its level, and among the open fields. The children on the whole, looked rather pasty and pale as if they were not enough in the open air, but were well nourished. There have been one or two mild outbreaks of ophthalmia in this school but never any severe or prolonged attacks. The third inspection was at the National School (*a*) of the town to which *A* belonged. In the boys' and girls' school 42·8 per cent. of 70 children showed sago-grain lids more or less marked, while in the infant school (100 children) about 40 were in the same state. In the boys' school one child aged 6, struck me as having exquisitely healthy lids, more so than almost any other. On inquiry I learnt that he was in a better social position than most of the others, was an only child, and was taken special care of. He looked remarkably healthy. Three or four of the infants whose lids were most healthy were also very vigorous looking and were socially above the rest of the children. The town containing these

schools has a population of 7000 and is situated nearly as high up as its workhouse (*A*). The inhabitants are a good deal engaged in woollen manufacture and many of the children are more or less employed in helping their parents in the work. The next examination was at the National School of a village of 816 inhabitants (*c*), situated five miles from (*a*), on the same oolitic soil, and about 700 feet above the sea. The parents of these children are all farm labourers. They are now able to live moderately well (wages 14s. a week) except in the matter of milk. This, the clergyman told me, many families never taste, as the milk of only two or three cows in the whole parish is sold by the farmers, the butter-milk being, as a rule, used for the pigs. In the boys' and girls' school 30·4 per cent. of 46 children showed follicular granulations, and the percentage among the 40 children of the infants' school was 32·5. Several of the children were pale, dirty and badly fed, but on the whole they looked more healthy than those at *a*. The only institution of a better class to which I have had access is the London Orphan Asylum at Watford which receives the sons and daughters of persons in the middle and lower middle class between the ages of seven and fifteen. I examined carefully the lids of 100 of these children, some having been many years in the school and a few only about three months. A large proportion (45) of this 100 had well-marked sago-grain granulations on the lower lids and several showed on the upper lids also. The worst cases were in children who had been in the school a long time and had entered it when situated on less healthy premises. The medical officer told me that nothing worse ever occurred than an occasional slight conjunctivitis from cold, &c. It is a very well arranged and well managed institution and the present premises have been built only three years. The children are well fed and well cared for in all respects. Their dormitory accommodation is exceptionally good, and the only respect in which it struck me that there was room for improvement in the matter of space was in the girls' day-room accommodation. Even this was, however, more spacious than at any pauper school that I have seen. This school would therefore, seem to show that in a well-managed institution, where the children are admitted only at long intervals and where none are ever taken in suffering from contagious ophthalmia, the existence of mild granular ophthalmia is a matter of very little, if any, importance. It is important to note also that in this school, as well as in the pauper and national schools above mentioned, there were no *bad* cases of granular disease. This is in great part attributable to the fact that no outbreaks of severe conjunctivitis had occurred, for no doubt most of the severe cases of granular lids are the result of granular ophthalmia aggravated by repeated attacks of acute conjunctivitis due to contagion or other causes. The well-known fact,

however, that pure granular ophthalmia, without any acute attacks, not very unfrequently runs on to bad granular lids, and that such an advanced condition is sometimes absent when the slighter forms are abundant, requires some explanation. In the first place it would seem to show that the disease bears a direct relation in *degree* to the *intensity* with which its cause has acted, no less than to the *duration* of its influence, since it is fair to suppose that the conditions of life are, on the whole, better in the two country schools above described, and certainly in the Orphan Asylum at Watford, than in many of the metropolitan pauper schools. We must, however, remember that the material on which the London schools work is worse as regards general health than that of the other institutions referred to. It is quite certain that, *cæt. par.*, the state of the general health and nutrition exerts a very powerful effect on the progress of the disease in its early stages, and probably in its later stages also.

Prevention of Granular Ophthalmia.—The curative treatment of the disease, being inseparable clinically from that of contagious ophthalmia, does not need separate consideration. For the same reason I shall not, in this part of the subject, make any suggestions for the management of large bodies of children in which granular disease is common, the measures to be adopted having reference largely to the prevention of contagion.

In respect to the prevention of granular ophthalmia in large establishments there is not, perhaps, much that is positively new to be said. In the children themselves the following points require particular attention. The disease not being contagious, so long as it is uncomplicated with muco-purulent discharge, measures taken merely against contagion in institutions where there was no contagious conjunctivitis would be worse than useless, since they would cause much alarm and expense. Such measures were formerly taken in some countries, especially Belgium, but it is unlikely that they would be recommended in this country.

As to *food*, I see no reason for thinking that its kind or quality has any direct influence in preventing the disease, except in so far as a well-nourished organism is more able to resist the cause of the disease than a badly-nourished one. As to its quantity and quality I believe there is no great reason to fear in our pauper schools. The cooking is not, however, always so good as it might be if a little more care were bestowed. Many are too apt to take for granted that food made of good ingredients must be palatable. I believe that variation of diet, within certain limits, is indirectly of considerable importance to nutrition by increasing the appetite, especially with children the majority of whom never have any holidays outside their school; it is particularly desirable with the very young children. Variation in the cooking is of quite as much importance as change in the articles of food. It is of still more importance that

the food when hot should be served really hot, and not lukewarm, especially in the case of boiled meat and puddings, and with the breakfast drink of milk or cocoa. It is also of extreme importance to train children, more particularly infants, against habits of daintiness and wastefulness with their food. Children between three and six years old are very apt to leave a meal (although cut up for them) almost untouched unless they are made or helped to eat it, and many of the elder children are very wasteful unless carefully looked after. The chief deficiency, so far as I have seen, in the *clothing* is the difficulty of washing the boys' cloth clothes. Their waistcoats and jackets get positively filthy from long wear. The trousers, being of corduroy or fustian, can be washed; but the cloth clothes often cannot be properly cleaned without almost coming to pieces, and then they are not worth making up again. There is no doubt whatever that the boys, as a whole, create far more disagreeable smells than the girls, or even the infants. This is, perhaps, because their work and play make them sweat more; but I think it depends also largely on the original offensiveness of cord and fustian (as Carter has pointed out), and on the greater dirtiness of their upper clothes. At Anerley the boys now have summer jackets and trousers of coarse linen which are washed weekly.

As to *ventilation* it is difficult to say anything in connection with these schools which is not a truism, or has not been said often enough already. Since facts, both general and special, point to organic matter impurity of air or moisture of air, or both combined, together with a somewhat high temperature, as causing the disease, I think we must expect to find it more or less prevalent in amount and degree according as the children are allowed to spend a large part of their time under this combination of conditions. In respect to day arrangements much may be done by introducing out-of-door schooling where as is often the case the schoolroom space is too small; and by allowing more playground space, either in a field or by letting them "fall out" and play about freely when out for walks. The ventilation of dormitories and schoolrooms is a most difficult question when cubic space and means of artificial warmth are both very limited. In the dormitories the necessary evils may be reduced by diminishing, as far as possible, the amount of body clothing in the rooms at night; a strong effort should be made to have this kept in a corridor or separate place at night, where it might be freely ventilated. No chamber utensils at all should be allowed in the rooms, except for children who are known to have dirty habits or to wet their beds. In some schools these children are put together into one dormitory, an excellent plan if only they be allowed at least double the cubic space allotted to others. Young infants also should have more space than elder children because of their dirtier habits, and because they cannot bear so much direct ventilation; artificial warmth is very

desirable in their sleeping rooms in cold weather. The greatest amount of direct ventilation that can be borne must be carried out. Practically this can be learned only by experience in each room, and can be maintained only by the constant supervision of some officer who understands both the necessity of fresh air and the danger of draughts. In cold, damp, sunless rooms fires ought to be lighted occasionally, and this is best done on days when they have been scrubbed, so as to dry the floors. It is, I think, a bad thing to allow blinds to be drawn down at night, except in cold weather; in warm weather, when there is not much wind moving, they very much interfere with ventilation. If, in summer, the early light is found to waken the children too early in the morning there can be no other objection to painting some of the window panes than that it makes the room look very ugly.

Contagious Ophthalmia.

It may be taken as certain, without any reasonable doubt, that, whatever the previous state of the conjunctiva, every inflammation of this membrane accompanied by muco-purulent or purulent discharge is contagious.

With respect to purulent ophthalmia, Stellwag (following Piringer) says that the intensity of the contagious power of the discharge varies directly with its degree of purulence and its freshness, and that it is in practice much diminished by free dilution with water, though this does not destroy the power of the individual particles of discharge. Its power is also much lessened by drying. In speaking of the discharge from granular conjunctivitis he says that when watery or merely consisting of turbid mucus it is scarcely contagious. In the milder forms of conjunctivitis we are bound on *à priori* grounds to suppose that, so far as the conditions are the same, identical statements will be found true; and this assumption is apparently borne out in many cases by clinical evidence of contagion.

There is much difference of opinion as to infection by means of particles suspended in the air. Most of those who have had large experience of severe purulent ophthalmia believe in this mode of communication, especially where many cases of the disease are crowded into the same room with healthy persons. It is far best to assume in practice that this is the case. Some have supposed that the discharge becoming dried and pulverised floats as dust in the air. Others assert that, finding its way down the lachrymal passages, it is blown out "as a spray of contagious particles" (Carter) with the expired breath (Graefe, according to Wells).

There are also differences of opinion as to the effects of transplantation on the intensity of the reproduced disease. Some authors assert that discharge from a mild case of conjunctivitis

generally gives rise to a mild form of disease, and in particular that the discharge from catarrhal ophthalmia almost always reproduces the same disease and not a severer form. Others believe that the malady is liable to become more intense, or to change in character, as it spreads from one to another, so that the discharge from catarrhal or from purulent ophthalmia may produce a severer form, and even cause granular lids; and that on the other hand, the discharge from a case of granular lids may reproduce a similar condition or either catarrhal, purulent, or diphtheritic ophthalmia. All agree that discharge from a severe form reproduces a severe form, but some say that in this instance the reproduced disease will tend to be milder than the case from which it was taken.

The uncertainty as to this relation between the producing and reproduced disease is owing in great measure to the fact that too little importance is generally given to the effect of follicular granulations in various stages on the intensity and duration of acute conjunctivitis. One result of this is found in the still current assertion (in the last edition of Wells's 'Treatise,' p. 58), that the discharge from catarrhal ophthalmia may reproduce granular lids, and that the latter may also by contagion again produce granular lids. These assertions, if true at all, are so in a very limited sense; they include perhaps cases of sago-grain granulations originating in the so-called "latent granulations," and others in which prolonged conjunctivitis in a case devoid of sago grains or nearly so, produces at length chronic papillary granulations. In view of the great prevalence of mild degrees of granular ophthalmia, nothing short of an accurate knowledge that the conjunctiva was healthy until the acute conjunctivitis set in will warrant the assertion that granular lids are produced by the discharge from a case of conjunctivitis. There are many careful observations on record showing that the discharge from conjunctivitis complicated with granulations, although reproducing acute conjunctivitis, is not followed by granular lids unless sago grains existed beforehand. The vagueness with which the title "catarrhal ophthalmia" is used by different authors is another source of uncertainty, for it is probable that if all the cases in which this diagnosis was made by different observers were collected together they would be found to include several well-marked clinical divisions, owning perhaps, very different causes. I shall for this reason avoid the use of the word as much as possible.¹

¹ The following would perhaps be some of the chief groups:

1. Conjunctivitis from exposure to cold wind. Acute, mild, very liable to relapse; not accompanied by conjunctival ecchymoses; not always symmetrical.
2. Conjunctivitis from dust and other irritants or from foreign bodies too small to be identified.
3. Conjunctivitis which sometimes accompanies acute catarrh of the upper air passages, whether this occur alone or as a part of measles or influenza.
4. Acute symmetrical conjunctivitis accompanied by intense congestion and

Several other circumstances are more or less recognised as having an influence on the severity of the reproduced disease. The patient's age is one of these; *cæt. par.*, the reproduced conjunctivitis will be severer in young than in older children, while it is said by McGregor to be worse in adults than in any children. The state of health also acts powerfully in some cases, though this is a subject while is surrounded with fallacies. Several severe epidemics of the disease in Ireland have occurred during periods of great distress or partial famine. This was the case with the epidemics of 1701, 1772, and of 1848-50. Wilde mentions "debilitated starved female children" as the worst subjects. McGregor says that two thirds of the children under his care in whom the disease caused loss of one or both eyes, had enlarged cervical glands or some other "marks of scrofula," or red hair. There can be no doubt that defective nutrition of the body increases the risks to the cornea, which are always serious enough in bad purulent ophthalmia. Sex appears to bear some relation to the severity of acute conjunctivitis; Wilde found the worst cases in the Irish workhouses among girls, and it has been observed in the London poor-law schools that the girls furnish the largest proportion of very severe cases. Race, probably, has some influence on the character of the inflammation at any rate in the case of the diphtheritic form, this being extremely rare in England and common in some parts of Germany. How far the degree and character of prevalent conjunctivitis are subject to the influence of general causes, independent of the source of the contagium and the state of the recipient, it is very difficult to say. Such influences, supposed or real, are spoken of by many authors under the titles of "catarrhal atmospheric constitution," "endemic constitution," "change of type," while others indicate without naming it. While far from denying the possibility of some general cause outside the organism which may stamp the character of the disease in many patients at or about the same time, I think no such hypothesis should be allowed until an effort has been made to avoid certain obvious sources of fallacy. It is easy, for example, to attribute to such a cause phenomena which may be explained by the prevalence of epidemic influenza or measles; by prevalent distress or famine causing a great aggregation of debilitated people; or even by some more local peculiarities, such as temporary overcrowding, the accidental accumulation of many feeble and unhealthy children in a particular school, the introduction of a very severe case from without, recent changes of management, and many other local circumstances.

In the metropolitan poor-law schools it is certain that a large
 often by conjunctival ecchymoses; getting well spontaneously and often affecting several persons in the same house at nearly the same time. Mr. Hutchinson teaches that this form resembles the specific exanthems, and that it occurs irrespective of age, health, or temperament, and, as a rule, only once in a lifetime.

proportion of the cases of muco-purulent conjunctivitis occur in children who were previously the subjects of more or less advanced granular disease. The proportion of the latter is probably smaller, but still considerable, in the children of the London poor living in their own homes; it may be expected to be much less among the poor of healthy country districts, and to be a relatively rare condition among those of the middle and upper classes; but the two last positions require proof.

It may be useful next to give a short account, such as my experience furnishes, of the chief varieties of mixed conjunctivitis and granular ophthalmia, which in the aggregate make up the bulk of what is often erroneously called "school ophthalmia," or "army ophthalmia," or "Egyptian ophthalmia." These terms are apt to mislead, and it is better to discontinue their use.

1. In examining a number of children with different degrees of granular disease some will generally be found in whom there is a very small quantity of opaque yellowish discharge. This is present in most cases either as a string or flake on the inside of the lower lid, generally far back, or else it is rolled up into a little yellow pellet which sticks at the inner canthus. Whether it is in all cases muco-purulent, or whether it may not in some cases be simply "turbid mucus" (Stellwag), without any recent pus-cells, I do not know. Practically this is of no consequence since it is a distinction which can be made only by a careful microscopic examination, and even then there might be some room for doubt; it is best to consider turbid mucus on the conjunctiva as muco-pus. This state of things always coexists with a considerably granular and congested state of the lids, at least of the lower lids, and these cases have already been mentioned under granular ophthalmia. I have said before that many of them if watched for a long time will be found to remain stationary, or to oscillate slightly, but never become worse as to discharge than is indicated in the above description. I mention them in this place again, however, partly in order to include every case which can possibly be supposed contagious, and partly also to remark that it is impossible to say certainly from a single inspection whether a case in this state will remain quiet or not. I believe, from considerable observation, that the practical contagiousness of such cases *when not progressive* is *nil*; and I think that the observer's action with regard to them should depend greatly upon whether he has or has not opportunities for personally inspecting them at short intervals. If he has such opportunities then these cases need not be separated from children who are healthy, or who have uncomplicated follicular granulations; but if more than a few days intervene between the inspections they should, as a preliminary step, be isolated. Such as never show more discharge may, after several months, be restored to the healthy children. Pathologi-

cally it seems right to include such stationary cases as belonging to pure granular ophthalmia with increased mucous or slightly muco-purulent secretion the result of chronic inflammation. With regard to those which now and then get a little worse the same is probably true, if we add the action of some local irritant which has temporarily increased the congestion and secretion; this view is supported by such exacerbations being often confined to one eye. As, however, there is no practical good to be derived from this view, it is safest to treat such variable cases as if they were just within the limits of contagious ophthalmia.

2. Other children will be found in whom there is constantly, or almost constantly, rather more discharge than in those of the first division. Sometimes their lids are glued together in the morning; sometimes the discharge will dry among the lashes into hard, yellow, semi-transparent lumps, or it may remain moist either among the lashes or at the inner canthus. It is often to a large extent mucous, often partly meibomian secretion, and probably its contagious power is small. It accumulates during the night, and often does not collect in the daytime to any perceptible extent, so that if well washed off in the morning the eyes may appear quite healthy to a superficial examination. Most cases of this kind are in young children from $2\frac{1}{2}$ to 7 or 8 years old. The lower lids show either evident sago-grains, or a more or less congested and thickened state by which these may easily be hidden if present. The discharge however, does not bear any fixed relation in different children to the condition of the lids, particularly in very young children; in these the conjunctiva occasionally shows very slight signs of disease, either follicular or papillary, although a notable quantity of discharge may form during the night. The discharge in this class of cases varies from time to time without any assignable cause, being sometimes all but absent for many days and then reappearing, but never going beyond moderate limits and not being accompanied by any subjective symptoms. Variations of temperature and moisture may have some influence on the discharge. It is a question whether some of these cases do not arise and last a long time without the presence of follicular granulations, and if this is the case it is probable that the disease may, when very chronic, give rise to permanent thickening of all the conjunctival structures and to papillary granulations. Sago-grain granulations may of course be formed under the influence of their own cause while this chronic slight conjunctivitis is in progress, and very probably this coincidence has among other reasons given rise to the theory that they are the result of the inflammation or of the contagion which may have caused the conjunctivitis. While holding firmly that follicular granulations are the result of a cause which does not in the first instance act on the other parts of the conjunctiva, I should think it highly probable that

any condition of chronic hyperæmia would aid its action. As a good many of these cases of slight chronic discharging ophthalmia probably go undetected and uninterfered with I think it has still to be determined whether or not they have a share in giving rise to the chronic changes, especially papillary changes, found in elder children. I do not know to what cause many of the cases here indicated are due. When the discharge is accompanied by proportionate development of sago-grains and by considerable papillary hypertrophy, it is easy to account for it by the action of sundry slight local irritants, especially dirt and cold air, added to the naturally high functional activity of the parts in young children. When the discharge is out of proportion to the structural changes it is probable that the disease is comparatively recent, and has not had time to give rise to chronic thickening, but whether in these cases it originated in contagion or not I do not know; from the mildness of the cases I should doubt contagion, and should be inclined to think that the disease is due to cold, damp, irritation by dirt, dust, &c.

3. A tolerably well-marked set of cases will be found in which, if treatment be omitted, a gradual relapse of all the symptoms takes place, until the child is found to have profuse, thick, yellow discharge and more or less congestion of the ocular conjunctiva, with or without some œdema of the lids; sometimes there is photophobia and pain, sometimes these symptoms are absent. The symptoms and course in these cases are tolerably definite and can be predicted with some certainty. There are always well-marked follicular granulations on the lower and often on the upper lids, with great congestion and thickening. By treatment the state of the lids can be much improved, but to a degree which varies with different cases although nearly constant in the same patient; the discharge can either be cured altogether or reduced to a very small quantity (with occasional exceptions, for here and there it cannot be reduced beyond a moderate amount of chiefly mucous discharge); the congestion of the eyeball can be completely or all but removed. This state of nearly complete cure can be kept up for an indefinite time by treatment. At length the treatment, having been carried on for many weeks after the above state has been reached, is omitted. After an interval, varying from a few days to several weeks, the conjunctiva of the lids, which had been almost or quite as pale as in health and more or less smooth according to circumstances, gradually reddens; the granulations, sago-grain and papillary alike, grow slightly from day to day; the discharge slowly increases; the large remote vessels of the ocular conjunctiva by degrees enlarge more, and this congestion extends day by day to the smaller ones and to those nearer the cornea until the exposed part of the eye has a dull reddish colour when seen at a few feet distance. Sometimes very quickly (in a single day), at others after a few days, all the symptoms in-

crease until the state described at the head of the paragraph is reached. If treatment is now resumed the symptoms quickly disappear and the case is soon as well as before; or if this be adopted so soon as signs of relapse are noticed the later symptoms will not be developed. With cases of this kind the same thing happens repeatedly, so that it is necessary to have them constantly under watch when not under treatment. They can always be kept well by treatment. The duration of the cure appears to vary directly with the total duration of the case, and with the time during which treatment was continued after the cessation of symptoms. After repeated courses of treatment the relapses also tend to become less severe; but this cannot be relied upon. Cases of this kind, if not treated early are very liable to the supervention of severe photophobia and to ulceration of the cornea, especially of its upper part. If ulceration has occurred in a former attack it is very likely to occur again.

There are cases, which must be included in this group, where the course is not quite as above described, the relapse being much more rapid and more severe. In some of these the rapidity of onset and intensity of the symptoms vary in the same case at different relapses without any evident cause.

4. Very many cases of granular ophthalmia, with or without much habitual discharge, can like those of the above class, be kept well or nearly so, by treatment, but are very subject to *slight* attacks or relapses of conjunctivitis, varying in intensity and in character, but never severe. No sharp line can be drawn between some of the worst of these and the less severe cases of the former group; yet I think on the whole the distinction here made is a useful one, separating cases known to be very liable to severe relapses and serious secondary mischief from those which show a very much smaller liability to these. The attacks here referred to are often sudden, or if gradual are at first so slight as to attract no attention. They are often unilateral throughout and always so at first. The second eye when affected begins to suffer from one to three or four days after the first and is often attacked more mildly than the first.¹ Sometimes they pass off spontaneously, but many get worse and some serious, if left without treatment. They are generally characterised by the appearance one morning of more or less congestion of the ocular conjunctiva, with or without slight increase or renewal of discharge. The congestion is often at first confined to the part of the conjunctiva opposite the palpebral fissure and in this feature the cases differ from those relapses which begin with gradually increasing congestion of the concealed part of the globe; it quickly

¹ This fact, which is a common one also in the severer forms of disease, is supposed by Stellwag to indicate diminution of intensity by transplantation.

becomes universal affecting the small as well as the large vessels, and by the latter feature is distinguished from the distension of the straggling larger vessels noticed as forming an early symptom of the more gradual relapses. In most cases the subconjunctival vessels are also involved, and in a few well-marked instances they are congested much more than those of the conjunctiva, so that the eyeball has a pink instead of a brick-red or mixed tint. Sometimes these attacks are complicated with conjunctival phlyctenulæ, the same patient sometimes having phlyctenulæ during one attack or in one eye, and not in the other eye or another attack. Many children have several of these attacks while not on treatment; they occur now and then, but much less often, while local treatment is being pursued. Generally no cause can be ascertained, but sometimes the children mention "cold" or "dust." Scarcely to be separated from these are certain children who are very liable to slight attacks of conjunctivitis from exposure to strong winds, especially, I think, easterly winds. These will be mentioned again further on.

5. Severe first attacks and relapses of inflammation are sometimes set up in granulous patients by foreign bodies on the conjunctiva and blows on or near the eye.

6. The last group calling for separate attention is that of corneal ulcerations. The ulceration being generally due to the granular state of the upper lid usually occurs on the upper part of the cornea, is superficial and accompanied by the formation of blood-vessels. It generally occupies about the upper third, or less, of the cornea, and often sends towards the centre a more or less pointed process of ulceration which may cover part of the pupil even though the lateral parts of the ulceration are considerably above the horizontal diameter. Ulcerated corneal phlyctenulæ are also far from uncommon in this disease, and in severity and duration are sometimes quite out of proportion to the state of the lids; when this is the case the corneal disease probably has nothing to do with the existence of granular lids. The same remark probably applies to small, isolated, greyish, nearly central ulcers which sometimes form and are apt to recur. Allusion has before been made to those cases in which the whole cornea becomes facettèd and more or less hazy from the effects of repeated superficial ulcers. These are very often associated with severe old ophthalmia tarsi, and abundant, florid, fine papillary granulations, sometimes without any visible sago-grains.¹

¹ The following facts as to relapses of all kinds which took place among about 375 children, between May 20 and Dec. 22, 1873, may be of interest.

Total number of Relapses, 215.—Of these, 134 occurred in 53 patients, giving an average of 2.5 relapses to each. The remaining 81 were, for the most part, single attacks.

Relation to Previous Treatment.—Relapses occurring while under strong local

Causes of Contagious Ophthalmia.—Though every form of purulent and muco-purulent ophthalmia is communicable by contagion, there is no form except gonorrhœal ophthalmia and perhaps ophthalmia of newborn infants which may not arise from other causes. It is scarcely needful at the present day to insist on the necessity of making full allowance in practice both for the actual and possible share taken by contagion in causing these diseases, more particularly in large establishments. But it is not enough to recognise only this cause, however much stress we lay upon it. By giving too large a share to contagion as a cause it is possible both to produce some needless alarm and to pass over other influences which account for a good many cases.

There can be no doubt, from clinical evidence, that epidemics of severe purulent forms of ophthalmia, however they originate, spread by contagion in all cases. In the extension of this, the most serious form of epidemic ophthalmia, contagion undoubtedly plays a part which eclipses all other causes. The definite belief in the contagiousness of purulent ophthalmia dates from since the Egyptian campaign, although there seems to have been some popular faith in it before that time; and the merit of first proving it by copious clinical details, in 1802, was claimed by Edmonston, surgeon to the regiment which first brought the disease from Egypt to England. The novelty of the opinion at that time is curiously shown by Edmonston's almost apologetic conclusion: ". . . yet (he says) the adoption of the opinion, that the Egyptian ophthalmia is infectious, may have its use." As early as 1789 Dr. James Armstrong recorded the details of a violent epidemic on board an English war ship, after the addition to the crew of three sailors suffering from it who were impressed from a slave ship (in which both slaves and crew were affected) in the West Indies. Edmonston quotes this as the earliest circumstantial account of contagion. Power, writing only a year later than Edmonston, and himself to some extent a contagionist, refers to the belief in contagion as

treatment 46 (of which number, 9 were due to some special exciting cause which was identified). Of the 32 patients who furnished these 46 attacks, 10 had 14 attacks at other times when not under treatment. Relapses occurring while under mild astringent treatment, 9 (very few of the children were on such treatment). Relapses occurring during omission of all treatment, 160 (total = 215). *Interval between Omission and Relapse* in 160 cases.—Two to seven days, 38; seven to fourteen days, 90; fourteen to twenty-one days, 17; twenty-one to twenty-eight days, 5; more than twenty-eight days, 10 (= 160).

Duration of Relapses.—In those coming on while under strong treatment (average of 24 cases in which it was noted) = 5.62 days. In those coming on while not under treatment (average of 72 in which it was noted = 7.62 days. Many in which the duration was not noted were very short.

Spontaneous Recovery from Relapse.—This occurred in 13 relapses, the average duration in 10 of them (where this point was noted) being 6 days. These were all very mild cases.

existing in England so early as 1790 when "a species of ophthalmia" was prevalent, and says that "a species of it is (1803) frequently prevalent among the Irish peasantry, which is considered by them to be infectious." It is I believe, certain that no suspicion of this cause was entertained when they left Europe by the great majority, if by any of the medical officers, either English or foreign, who served in the Egyptian campaign, nor did this belief exist in Egypt at that time. Many years later (1825) Mr. Abernethy said he had been fully persuaded that purulent ophthalmia was contagious "long before our troops went to Alexandria," and again, "it was always considered so (*i. e.* catching), and people used to talk about catching sore eyes." McGregor in 1804 published some accurate evidence of contagion when the disease occurred among the children of the Royal Military Asylum. This was followed, in 1807, by accounts from Peach and Vetch of the disease and its contagious nature as it occurred from July 1805 to 1806 in the second battalion, 52nd Regiment, at Hythe and other barracks in Kent. Its introduction into this regiment was attributed at the time to the entrance of a recruit or recruits from an Irish militia regiment, which had suffered severely from it in Ireland and was said to have taken it from the 79th Infantry Regiment. The last-named corps brought the disease from Egypt to Ireland, and the militia regiment above mentioned had in Ireland been garrisoned with it. But the doctrine of contagion was far from universally accepted for many years, for as late as 1826 Mr. Lawrence treats it as only probable.

It has already been mentioned that purulent ophthalmia when concentrated probably may be and is communicated through the air; this occurs at distances of perhaps a few feet, as from bed to bed. This was believed by the earlier contagionists and supported on their part by many most instructive facts; it has been held in turn by most of those who have had to do with epidemics of the severe disease and is still the generally received opinion. It is of course very difficult to prove, but we shall do well to assume its truth when a good many cases of ophthalmia, producing abundant purulent or mucopurulent discharge, are placed in a confined space with healthy persons. I disbelieve strongly, however, that conjunctivitis can be communicated in this way unless the discharge is very abundant, nor is it at all probable that articles of clothing or towels hanging in rooms so occupied would filter out so much of the discharge from the air as to become potent sources of contagion, or even practically contagious in any degree at all. The disease stands, perhaps, midway between those which are very easily communicable through the air, and such a one as porrigo (contagious impetigo), which requires the direct transmission of a particle of discharge by the fingers or towel &c., to a healthy skin. It cannot,

in this respect, be fairly compared with ring-worm, where the contagious material is dry and powdery or scurfy.

So far as I have seen, the clinical evidence of contagion as a cause of mild and moderate attacks or relapses of muco-purulent ophthalmia in a carefully conducted school is very small. In the school infirmary which was under my charge, there were many cases of uncomplicated granular ophthalmia in very various stages, a good number of them having but little discharge. There was also a moderate number in whom more or less of granular disease was complicated with considerable discharge. Although, as a rule, the cases with most discharge slept in the same wards, it was impossible for practical reasons to fill any ward with such cases, so that they were always mixed at night with a certain proportion of others in whom there was little or no discharge. In the daytime the cases having most discharge were kept in their wards (not in bed except in rare cases), and were then often mixed with those who were warded for other reasons. This mixture was even greater among the youngest children, whose ward it was necessary to convert into a day nursery where not only some children with discharge, but others with none remained for many hours in bad weather. This somewhat promiscuous arrangement of the children was, as far as possible, neutralised by strict precautions intended to prevent the direct transmission of discharge from one to another. These were chiefly the strict provision of a separate towel and separate basin for each child (the towel being hung at the bed-head), and the plan of having the eyelids of every child thoroughly cleaned with small pieces of wet tow the first thing in the morning, each bit of tow being used only once and then thrown into a special receptacle and afterwards burnt. If acute conjunctivitis with moderate muco-purulent discharge, were so contagious as is sometimes implied in general statements about ophthalmia in schools, I should probably have had numerous cases of more or less severe disease originating and showing evidence that they were due to contagion, notwithstanding the precautions above described. I should add that the measures (which were as stringent as circumstances allowed) were taken at a time when I fully believed in the doctrines of the extreme contagionists and was under the belief that contagion would be an everyday event unless they were taken, and that it might even occur independently of them. I have very gradually, and almost unwillingly, come to believe that contagion is not a very frequent cause of first attacks or relapses of muco-purulent ophthalmia in institutions under tolerably good management.¹ The hypothesis of

¹ It will be objected that schools under "tolerably good management" do not furnish much ophthalmia. True; contagion doubtless accounts largely for ophthalmia, when abundant; but in a pauper school where follicular granula-

contagion is so simple and explains the facts so well, that knowing its possibility we are easily led to assume its actual occurrence in many cases which are due to other causes. I have seen very few cases in which there was any good reason to believe in its occurrence, and I believe that in such cases as I have had under care, and as are common in similar institutions, contagion is not by any means always the cause. Welch holds very similar views with regard to cases of the same or even greater severity. In speaking of conjunctivitis in men with follicular granulations he says that in only three cases, among a large number of which he is writing, was there evidence of positive purulent inoculation, and that in no less than 68 per cent. of the cases there was "no ascribed cause." He is strongly of opinion that contagion has a very small share either in originating or maintaining the comparatively mild ophthalmia which now supplies the bulk of the army cases. Among the principal reasons for this belief he mentions that the disease is not eradicated by measures based chiefly on the hypothesis of contagion, and that on the other hand, it often does not spread from chronic cases to healthy men under conditions favorable to contagion. He thinks that contagion has a large share in spreading it when there is much overcrowding, but that there are many other important causes which will continue to act after the facilities for contagion have been abolished. Dr. Pontus has made a somewhat similar statement, based on the result of his experience in a large military house of detention. He found with surprise, that a considerable number of men with mucous discharge, and a few in whom it was mucopurulent, lived and slept among the healthy men without fresh or acute cases arising, and that this state of things had been going on more or less for sixteen or seventeen years.

My own opinion being based very largely on old cases, and on the evidence afforded by relapses, may perhaps be objected to on the ground that many cases which I attribute to relapse are really due to fresh contagion. It has been already mentioned that under good conditions as to cubic space, cleanliness and precautionary measures many children with uncomplicated though severe granular ophthalmia in various stages may live among a number of others, some of whom have a good deal of discharge, without ever getting an acute attack. I have also stated above that those cases which relapse preserve as a rule, the same characters throughout all their relapses, so that in each patient the character of the relapse can often be predicted; and further, that in many cases the relapse comes on gradually, beginning in a slow increase of the roughness of the lids. It is especially with the worst cases that I have carefully observed this, and it is just these which would most likely be

tions are very common, there will probably always be some acute and chronic mucopurulent cases, even when contagion is rendered practically impossible.

caused by contagion if this were in operation. Again, the worst relapses generally occur in those cases which have, when not under treatment, had the most discharge; it is but seldom that a bad attack occurs in a child who at first had a scanty discharge, except in cases of old scarred and seamed lids where some definite cause of irritation (cold draught from a window open at night, a blow on the eye, or a foreign body) brings on a violent attack with ulceration of cornea. In slighter relapses, when the ocular congestion comes on suddenly, or appears to do so, it is impossible to disprove contagion, except by the negative evidence that it would probably cause much severer attacks than these. Another reason against this cause is to be found in the not infrequent occurrence of relapses in groups which have no reference to the arrangement of the children in their dormitories, or to their special occupations, but which are sometimes related to sudden changes of weather, or to the children having all been out for a walk on a windy day. This experience is borne out by what I have seen at another school (a very well-managed one) where some cases of moderate relapse, or of chronic muco-purulent ophthalmia with granular lids, were allowed to mix with healthy children without any harm.

Not more than three or four cases occurred under my charge in which there seemed any good ground for thinking the attack due to contagion, and in several of these there was great doubt about it; they were all severe. The only instance in which there could be no doubt was that of a newly appointed nurse, who, coming fresh to the work and not having learnt or attended to my directions, herself began to suffer from acute ophthalmia in the right eye within three or four days of her arrival. The disease made rapid progress and was accompanied by severe œdema of the lids and abundant discharge, and the other eye then became affected. It was soon cured and her lids became perfectly healthy in about three weeks. The second eye was not so severely affected as the first, probably because treatment was begun earlier in it. I could not, even in this case, trace any contagion; the woman denied knowledge of it, and the cases under her care were all or nearly all mild as to discharge. Another very suspicious case was that of a young kitten which had slept under the bed-clothes of a girl who had bad granular lids and was subject to occasional attacks of bad conjunctivitis. The kitten after sleeping with her for two or three nights showed symptoms of acute ophthalmia in one eye; it never became very severe, and did not affect the other eye.

The commonest vehicles of contagion are probably fingers, towels, and pocket-handkerchiefs. To these must be added sheets and pillow-cases if more than one child sleeps in each bed. Next to these probably come water and washing utensils. There are well-authenticated cases of gonorrhœal ophthalmia being communicated

by the use of a towel soiled by urethral discharge. It is difficult in practice to distinguish the share taken by foul water and basins from that due to towels, and notwithstanding the experiments of Piringer which show that the discharge is rendered much less contagious by free dilution with water, I think there should be no relaxation of vigilance in this particular, especially as it is said that the water acts only by lessening the adhesive power of the discharge and not by destroying its efficacy. I never found any evidence of intentional inoculation, nor could I hear of any cases from the nurses or other officers. It is probably a very rare occurrence, if it is ever done at all.¹ Flies are considered by some authors (McGregor, Anagnostakis, Burton) to be an important vehicle of contagion, especially in hot countries. This can take place only where, in consequence of extremely dirty habits, the discharge is allowed, as in Egypt, to accumulate about the eyelids.

The contagious material need not be derived from the conjunctiva. The best known instances in which it is furnished by other surfaces are of course gonorrhœal ophthalmia and ophthalmia neonatorum. Edmonston has known "a severe ophthalmia to be produced in a child from bringing into contact with the eyes the matter adhering to the dressings of a foul ulcer." Ware relates a case of purulent ophthalmia, followed by slough of cornea, in a woman who for several days before the attack began had been frequently syringing her two little girls who were suffering from vaginal discharge. Sperino believes he has proved that severe purulent ophthalmia is sometimes produced in children by the discharge from impetiginous blepharitis and from impetiginous eczema. Experimental inoculations have been made with discharge from purulent ophthalmia in various stages, on the conjunctiva of the same and of different persons, by several surgeons. Mackesy experimented on himself with a negative result (1816). Guillié (1824) proved that the discharge of purulent ophthalmia neonatorum reproduced the same disease in other children of ten to fourteen years old, one of those experimented upon having already lost both eyes by the disease in infancy. Piringer (1841) showed that purulent ophthalmia was communicable from one eye to the other, and from the urethra to the eye. Later, gonorrhœa in both men and women was experimentally produced by inoculation with discharge from ophthalmia neonatorum (Landau and others), and from purulent

¹ Three children were at various times reported to me for having purposely tried to aggravate their ophthalmia by rubbing their eyes, &c. One was probably untrue, as the patient was a stupid, lethargic boy, who appeared to care very little what was done or said to him. One was an intelligent girl who wished to remain in the ophthalmic school instead of returning to Auerley, and was reported to have rubbed her eye to make it red just before I examined her for the purpose of seeing whether she was fit to return. The third, also a girl, was said to have said that she would do the same, but I never found that she did it.

ophthalmia of adults (Thiry); and each observer saw a second gonorrhœa caused either experimentally or in the usual way by these primary cases. Thiry has seen a mild urethritis follow inoculation with discharge from a mild ("catarrhal") form of ophthalmia.

With respect to the lower animals purulent ophthalmia was caused in dogs and cats by the discharge from the same disease in man, by Vasani in 1816, and I believe by Graefe about the same time. Buzzi, in 1825, obtained similar results with the same discharge in dogs, goats, and sparrows. De Condé (about 1841) observed violent ophthalmia, leading to blindness, in a sergeant's dog which habitually slept in its master's bed, the sergeant himself having lost an eye from the disease and still having much discharge. In another case, mentioned by the same author, a little boy suffered from bad purulent ophthalmia soon after being locked up for punishment in a kennel with a dog which was the subject of "extremely violent" ophthalmia; careful examination revealed no other possible source of contagion. Animals therefore are a possible source of contagion.

Other causes.—If we deny the first place to contagion in causing primary attacks and relapses of moderate mucopurulent ophthalmia, except under conditions of very great overcrowding and very bad management, it is not easy to point to those which generally do give rise to these cases. A large proportion of the relapses are I believe due, as has been already said, simply to the gradual sprouting, without any exciting cause, of the chronically diseased conjunctiva which had been repressed by treatment. In some, on the other hand, the conjunctiva having become under treatment nearly or quite smooth and pale, will remain so for a long time, and if occasionally examined will not show any retrogression towards disease, when from a slight cause a violent relapse will occur. The same slight causes sometimes bring on first attacks, and many of the less severe relapses can be traced to one of them. Of such slight causes ("slight" because the effects produced are out of all proportion to those which would follow their action on healthy eyelids), those which have come most under my notice are the following:—*Slight blows* in the neighbourhood of the eye or on the eyeball caused violent purulent ophthalmia with great œdema of the lids in three children. All were cases of old granular lids and in two of them the lids were scarred; two of them had previously suffered from bad attacks, and the third probably. The same cause brought on a first attack of tolerably severe and very persistent mucopurulent ophthalmia in a little girl of five who had previously had red lower lids and perhaps "latent granulations;" abundant sago grains rapidly appeared in her lids. *Draughts from over-ventilation at night* caused bad relapses in two or three cases of old granular lid in which there had formerly been corneal ulceration,

and several slighter ones were attributed by the patients to this cause. *Strong wind during the daytime*, especially while out for a walk, brought on several bad relapses in old cases and many slighter attacks, some of these being primary. I think a cold dry wind is the most dangerous, but warm, moist, gusty winds are by no means free from risk. I am inclined to think it is chiefly the wind, and only in a less degree the dust raised by it in dry weather, to which these relapses are due.¹

Foreign bodies and dust.—It is difficult to ascertain how many cases are due to these causes. It is not uncommon in examining a number of children with uncomplicated granulations to find several with an eyelash, or a particle of dirt or of coal, on the lower lid without the child being aware of it. There is often increased redness of the eyelid and a flake of yellow discharge, while these are absent from the opposite eye; but these disappear as soon as the cause is removed and no further trouble ensues. A good many children, on the other hand, who have various degrees of relapse, will tell you that the attack began from getting some dust or dirt into the eye. I have no doubt that very often the subjective feeling of grittiness caused by the roughening conjunctiva does duty for a foreign body. In a few instances there seemed satisfactory evidence that a foreign body had begun the attack. In one of these a tolerably severe first attack in one eye was caused by a minute chip of coal; the chip did not injure nor remain on the cornea. This boy had previously had a moderate number of scarcely perceptible follicular granulations with moderate congestion ("latent granulations"); these rapidly enlarged and remained in this state for many weeks, and were still the same when the boy passed from under my care; his other eye was not attacked.² It is worth noticing that this boy's sister, who had been under treatment before I was in charge and had follicular granulations when I first saw her, had a violent relapse of muco-purulent ophthalmia in both eyes from no

¹ On the cold, dry, windy, and dusty days of March, April, and May, it was a common thing for several relapses to occur in a day, especially after the children had been for a walk. 33 such cases occurred on eighteen days in March, April, and May. But a considerable group also occurred during damp, gusty weather in the early part of December (14 cases in five successive days). During these same days in December 8 other people in the house had various slight ailments supposed to be due to "colds." As to the effect of very damp, foggy, rather cold weather 10 cases occurred on four such days, during two of which 3 other persons had stiffnecks; while in eleven days of warm, clear, balmy (? moist) weather without wind or rain, in April, only 4 cases happened. These facts, so far as they go, bear out the statements made by authors that cold damp air is apt to bring on relapses, and that the same is likely to be the result of strong, gusty winds, whether accompanied by dust or not, though it is probable that dust adds to the bad effect of the wind.

² I saw him again several months later and found abundant large sago-grains on *both* lower lids, the advance of the disease in the second eye being most marked but having occurred without any acute attack as in the eye first affected.

assignable cause several months before her brother came under care; at the time I thought it due to contagion, but had no positive reason to suspect this. She remained subject to relapses, which more than once again threatened to become severe. Both these children were sanguine brunettes with thin skin, and very intelligent. In two or three others relapses were attributed to particles of bath-brick while cleaning knives, and in one to chloride of lime. Soap¹ running into the eyes while washing, or rubbed in by another boy, caused rather bad relapses in three cases. On the whole, fine dust such as is raised by sweeping rooms and passages, or even yards, does not appear to have done much harm; at least I could never distinctly trace relapses to this cause. It is to be noted that all the six cases in which a foreign body (dust or soap) was most probably the cause had a great tendency to relapse, as shown by this having already occurred at least twice before in four of them, and once in one other, while subsequent relapses took place in three or four of them.

There can be no doubt that in very sandy and dusty countries—Malta, Egypt, Algeria, &c.—the dust is a much more important cause of acute conjunctivitis than in this country. The finer prickles of a kind of caetus which float in the air at a certain time of the year are stated to be one cause of ophthalmia in Algeria (Furnari).

Measles.—The experience of thirty cases of measles which occurred in the months of August and September showed that it has, as might be expected, a bad effect on cases of granular ophthalmia. The conjunctivitis which accompanies measles sometimes persists for many weeks afterwards with a good deal of discharge and an increased roughness of the lids. Troublesome phlyctenulæ also sometimes come on. In a brother and sister, who before had shown a very moderately though decidedly granular condition with little discharge, the lids became much thicker and redder and the discharge abundant; these symptoms persisted in spite of treatment and of long periods of omission for several months. These two children were alike in features, and both had very thick loose lips and large mouths. According to Kriebel an epidemic of ophthalmia in a school for sons of soldiers at Annaburg was caused, in the autumn of 1825, by the appearance of measles. It is stated that many of the children who were not under treatment for ophthalmia had conjunctival granulations.

Other causes mentioned by authors and of considerable importance are the following. *Rapid lowering of temperature at night.*—Many of the early writers on Egyptian ophthalmia stated that exposure of the head to the air during sleep at night was a very common cause of acute ophthalmia. It is said that the same often occurs in Malta

¹ Bad soap is mentioned by Dr. Edward Smith as a cause of ophthalmia in schools.

where some persons have an attack every time they sleep in the open air, and that it is a frequent cause of an ophthalmia which becomes epidemic every year at Aleppo. It is repeatedly stated that those escape who take the precaution to cover their heads when sleeping in the open air, or to sleep under cover. It is to be observed that in the countries where this happens there is often heavy dew and a great fall of temperature at night. Massy is strongly of opinion that among the soldiers at Athlone acute attacks or relapses of "severe conjunctivitis" were often caused by mounting guard on a cold, exposed spot at night, directly after coming from a hot, close guard-room. He says it may come on so severely in two hours as to disable a man from continuing on duty. Change from the hot guard-room to cold night air is the only cause of relapses which Welch was able to identify with certainty in his regiment. Cooling of the extremities during rapid fall of temperature at night is a secondary cause in Egypt, according to Anagnostakis.

Damp.—In speaking of moisture of air in relation to granular ophthalmia, it has already been mentioned that one source of fallacy in respect to its share in that disease is the fact that it undoubtedly has an influence in the production of some forms of acute conjunctivitis. While it is probable that moist air at a *high* temperature has much influence on the development of granular ophthalmia, its effect in causing acute conjunctivitis is in all probability, due to a rapid *lowering* of the temperature of the air and of some part of the body. This is commonly stated in the case of hot climates like Egypt and Malta. In a sandy, but damp, foggy part of Demerara, Chisholm tells us that both natives and Europeans were, in 1794, notoriously subject to *ophthalmia membranarum*. Redmond mentions a good instance of wet causing cold and thus relapse, in which thirty men with ophthalmia sleeping in a tent became much worse after a single night's violent rain which obliged them to leave their beds and stand in the middle of the tent to avoid getting drenched. Vetch also states that regiments stationed in some very damp parts of Kent suffered more severely from ophthalmia than almost any others in the kingdom. De Condé mentions a severe epidemic in a temporary camp on a low part of the shore near Naples in 1815, where the wind was very damp. In all these cases, whatever effect is attributed to the damp, is probably in reality due to rapid lowering of temperature. A few authors attribute considerable influence to hot moist air; *e.g.* in Egypt during the Nile flood, acute ophthalmia, according to many writers, becomes much more frequent, while other catarrhal complaints do not show any increase (Anagnostakis). Redmond, writing of ophthalmia in a British regiment stationed in Jamaica in 1808, says, "I have observed that the hottest weather, accompanied with a dry atmosphere, had such a powerful effect in diminishing its violence as to reduce

our numbers at one time to twelve convalescents; but the rainy season setting in, the admissions became daily increased and more violent." In Malta, Hennen thinks the hot moist sirocco brings on many attacks, and sometimes causes a deterioration of all the ophthalmic patients in a single night when it begins to blow. He gives details, showing the number of acute cases and relapses admitted in two successive weeks, during one of which the dry winds prevailed while the hot, moist sirocco blew every day of the other week; the numbers are eight in the former and twenty in the latter. It may be doubted, however, whether much of the effect is not due even in these cases either directly to cold air or to evaporation from the surface of the body, for in the same countries the nights are often spoken of as remarkably cold. Vetch appears to attribute the bad effect produced on cases of vascular cornea by air saturated with moisture to the prevention of evaporation from the vessels, so that these remain distended; he says that these cases always get worse in such weather and require more care in the application of remedies. This observation may be of value in connection with Müller's statement that the conjunctiva is susceptible of perspiration and inhalation. Careful observation may show that it explains some of the sudden and, at present, quite unaccountable changes which take place, either for better or worse, in the degree of vascular turgescence and accompanying corneal infiltration in some cases of partial pannus.

Overcrowding.—Most authors agree that destructive purulent ophthalmia may arise under conditions of great overcrowding, without the introduction of a severe case from without. The most typical instances are supposed to be those frightful attacks of the disease which used sometimes to spread through the slave ships, and of which an instance is given by Armstrong as happening about 1789 and two others by Guillié in 1819. Most of the epidemics in which many severe cases occurred, in transport ships, barracks, schools and workhouses, have been coincident with great, sometimes intense, overcrowding. The overcrowding in Cairo is stated by Anagnostakis to be almost incredible (1857). These facts do not show that crowding can produce purulent conjunctivitis any more than the occurrence of smallpox under the same conditions proves its spontaneous origin. For obvious reasons it is impossible in such circumstances to say that there were not at first some cases of old granular lids; and if this be granted we have at once a starting-point for purulent ophthalmia, for every one knows that this condition is very apt to be set up in such patients by various causes when there is no overcrowding in question. Among a large collection of men it would be almost impossible to be sure that some were not suffering from gonorrhœa in some stage, another source of contagion. The known facts in the cases of temporary crowding can therefore easily be accounted for by the increased facilities for

contagion which are thus afforded. In permanently overcrowded buildings we must add the probable presence of many persons who being already the subjects of granular ophthalmia in various stages and degrees, are thereby rendered very liable to bad conjunctivitis.

Prevalent mild Ophthalmia.—Many epidemics of severe ophthalmia in regiments, schools, &c., have been traced not to any single imported case of severe disease, but to the existence of a prevalent mild form of conjunctivitis in the establishment or district for a short time before the severe disease began. There are many circumstantial accounts of such occurrences on a large and small scale, and it is probable that this cause has now and always had a larger share in the production of destructive epidemics both in armies and schools than the importation of severe ophthalmia from Egypt. We are constantly told that in Egypt itself acute conjunctivitis varies much in prevalence at different seasons, and in both prevalence and severity in different years. Such mild prevalent ophthalmiæ are generally called “catarrhal” by authors and the cases are usually described as of short duration, to which are sometimes added more details, such as rapid onset, symmetry, the occurrence of conjunctival ecchymoses, &c. Sometimes they are attributed to cold winds, at others to an “epidemic catarrhal constitution” appearing in different forms in other patients, at others to a prevailing epidemic of influenza. Epidemics of this nature sometimes cease entirely in a few weeks; many instances of this are on record. In other cases they form starting-points for prolonged and severe ophthalmia which sticks to the regiment or school for years. Such a result is to be attributed, 1st, to the previous existence of abundant follicular granulations among the patients, by which each case is much prolonged and often rendered much more severe; 2ndly, to facilities for contagion; 3rdly, to a prevalent state of low health, which, apart from the presence of granular lids, probably makes the conjunctiva more susceptible to causes of inflammation. It may be remarked here that an examination of the early history of severe ophthalmia in the British army renders it nearly certain that the epidemic influenza of 1803 acting on Irishmen, who (civil and military alike) were predisposed to bad ophthalmia by follicular granulations, had a larger share in the production of the destructive ophthalmia which raged after that date than cases imported from Egypt. Gonorrhœal ophthalmia, no doubt also took a share, but it is impossible to say how much. These causes were much aided by facilities for contagion due to the introduction of the barrack system and to increase in the size of the army.

Treatment.

Before beginning to treat mixed granular and contagious oph-

thalmia it is very necessary to form an idea as to the effect for which we ought to hope. This is a point on which we are, I think, apt either to be over-sanguine on the one hand, or on the contrary, finding the matter a more troublesome one than was anticipated, to rely too much on the expectant plan.

Conjunctivitis unassociated with follicular granulations, or with the complex granular lid of which these are the earliest stage, is as a rule easily curable and has no tendency to occur again without a renewal of its exciting cause. Conjunctivitis occurring in a person with granular lids is not so easily cured and is very liable to be excited again by extremely slight causes. Further, the acute inflammatory attack often adds much, not only to the temporary activity of the chronic granular disease, but to its permanent development. The wave of acute disease leaves behind it an increased growth of the morbid tissue and a permanently increased functional activity prone to show itself by further growth. The chronic tissue-change constituting the granular disease will cease spontaneously after a time, but this end may be much hastened, the granular condition kept much in check and the accompanying risks much lessened by local treatment. The objects to be gained by local treatment are therefore first, to cure acute conjunctivitis, both for the patient's own sake and to prevent it from spreading by contagion; second, by checking or so to speak starving the granular disease to diminish its prospect of leading to corneal damage while in progress, or of becoming bad enough to cause deep and extensive scarring of the lids, and by keeping the conjunctiva in an anæmic and quiet state to lessen its susceptibility to the various causes of inflammation.

The attacks of acute inflammation speaking in general terms can be cured by astringents. By the same means the chronic tissue-changes of the granular disease can be kept in check and gradually diminished. This constitutes, on the whole, by far the safest plan of treatment; but we may, in addition, set up at tolerably short intervals a certain degree of acute inflammation, as a result of which some of the morbid tissue will generally be absorbed. The merely astringent plan sometimes has no effect on granular lids; while the weak points in the second method are found in its liability to set up too great an inflammation, and thus to increase instead of diminish the disease, and in the impossibility of predicting, from the mere appearance of the conjunctiva, whether this will happen or not. When, as is the case in the treatment of large numbers, a certain amount of routine practice is almost unavoidable, I think it will always be found better to rely on the astringent plan for the bulk of the treatment, reserving the powerful or caustic applications for such cases as require and can receive more separate attention.

In the selection of astringents we may be guided by several considerations. The treatment of acute conjunctivitis may consist

either in the use of a weak solution often or a strong application at long intervals. In the severer and invaliding cases it does not much matter, so far as the patient's time and occupation are concerned, which plan we adopt. Probably the best and shortest cures will always on the average be obtained by a combination of the two plans, because the weak solution can be made, when used freely, to serve the double purpose of a cleansing and a therapeutic agent, whilst the use once in twenty-four hours (sometimes twice in very bad cases) of a powerful agent will shorten the attack very much and lessen the risk of corneal damage.

For the treatment of granular lids without acute conjunctivitis, weak astringents are of little or no use; indeed, they sometimes act as irritants and increase the disease. But if experience were conclusive as to their efficiency, it would still be found much better to use a strong remedy seldom than a weak one often. The course of granular ophthalmia is so long that it is of great importance to prevent the treatment from taking up more of the patient's time and attention than absolutely necessary. This is obvious enough in the case of adults, and a little consideration will show that it is no less true for children. It is no uncommon thing for a child with granular lids to have from two or three to a dozen attacks of ophthalmia requiring treatment in three or four years, or a shorter time; these if treated by weak applications often last for many weeks, or even several months, so that such children not only lose a large part of their time idle in the infirmary, but are subject to the disheartening process of having constantly to learn subjects over again in school which they have half learned, perhaps, several times before. Besides the actual loss of school-time there is, of course, very often a great gain of bad habits, the result simply of idleness. It is, therefore, of great importance that treatment in all cases which admit of it—and they form a very large proportion of the whole—should interfere as little as possible with the ordinary school work. This object can be gained only by reducing the number of applications to a minimum, and making sure that when practised they are efficient.

The next step is the selection of cases which require treatment, and this is not quite so simple a matter as it seems at first sight. There can be no doubt as to cases of acute conjunctivitis. These, however slight, should always be treated or at least sent to the infirmary, because, however slight such a case may be, we cannot always tell by the early symptoms whether it will be severe or not, and whether it will pass off spontaneously or not. Then, all cases should be treated in which there is persistent discharge (unless this be only a very little mucus or watery material), whether the lids are granular or not, and all cases of ophthalmia (sycosis) tarsi. It is in the cases of granular lids without discharge, whether acute attacks have already occurred or not, that it is difficult to decide on the pro-

priety of treatment. This difficulty arises, first, from the want of fixed relations between the subjective and objective symptoms; secondly, from imperfect knowledge as to the final result of natural cure in moderate or even bad granular disease unaccompanied by subjective symptoms; thirdly, by the impossibility of predicting accurately how much and what kind of effect any given treatment will have until it has been tried; and, fourthly, from the similar difficulty of saying, merely from the appearance, what are the risks of relapse or of acute conjunctivitis occurring if the case is left alone.

It may be safely laid down as a rule that treatment should be carefully tried for a long time in all cases where there is intolerance of light or spasm of the lids, and of course where there is active corneal disease. There is some difference of opinion and much difference of practice, however, in the case of severe uncomplicated granular lids without symptoms or discharge, or with, perhaps, a little mucous or watery discharge. I think that all the best experience is in favour of treatment for most of these cases—first, in order to reduce their prospects of acute inflammation being set up by slight causes; secondly, to lessen the probability of corneal damage by the mechanical irritation of the rough lids; thirdly, to diminish the prospect of remote bad effects on the curvature, &c., of the lids. All these objects are attained when by treatment the congestion and roughness of the palpebral conjunctiva can be reduced and its irritability diminished. There is less concurrence of opinion in favour of treating early granular disease without much or any congestion or thickening of conjunctiva, and without symptoms. If the effects of treatment on these cases were certain to be good it would clearly be right to treat them all, but in the slight and early forms of the disease there is so much probability of provoking by treatment just such an acute conjunctivitis as we are labouring to avoid, that I think the patients will as a rule be more likely to escape future attacks of inflammation and aggravations of the granular state if left alone, *in moderately good hygienic conditions*, than if subjected to local medication. I should apply this rule at least to large collections of such cases; under circumstances where a good deal of attention can be given both by patient and surgeon, more of them may, perhaps, be treated with advantage.

There will be a few exceptions to some of the groups indicated above. There are some cases of granular lids with chronic discharge, chiefly of a watery and mucous character but easily becoming purulent, in which no treatment, either by weak or strong astringents or caustics, in whatever form, either in solution or ointment or solid, does any good, but, on the contrary, often does harm. The same now and then occurs, but less often, with cases of granular lids accompanied by persistent photophobia, with or without some discharge. In some of these atropine is a help—in some it is of no use

at all. These exceptional cases are all the more puzzling because sometimes it appears that the same treatment which did harm at one time does good some weeks or months later, or *vice versâ*, without any apparent change having taken place in the mean time.

The effects to be expected from local treatment.—One of the most important rules to be remembered here is that (excepting as regards the cure of acute conjunctivitis) there is no uniform state of improvement to which all cases of granular disease of the same severity can be brought by treatment. In this respect every case has its own standard beyond which it cannot be carried, and this can be found with safety and certainty only by experience in each instance. In some patients the congestion and roughness can be entirely removed¹ from the upper lids, and almost from the lower, and this state be maintained indefinitely by treatment. Below this point of excellence are all degrees of variation down to the point at which the most powerful treatment that seems safe has no effect at all beyond causing transient irritation; this complete want of effect seldom if ever occurs except in very old cases. Running parallel with cases that are benefited are a few others in whom the symptoms point to the necessity of treatment but which are positively injured by treatment of any activity; these are not numerous.

Duration of Treatment.—This also can be determined only by experience in each case. It can seldom be measured by anything less than months, and many cases require it at intervals for years. It is of much importance not to omit treatment entirely until several weeks (four to eight) after the case has reached the greatest amount of improvement of which it is capable. This should be done gradually, *i. e.* by increasing the intervals between treatment; and after its entire omission the lids should be examined at intervals of about a week, so that any gradual sprouting of the conjunctiva may be detected early. I attribute some relapses in the cases under my care to a partial neglect of this rule, for scarcely any relapses occurred when all the worst cases were under treatment without any experimental omissions.

It does not seem likely that anything will be found equal to nitrate of silver and sulphate of copper as local applications. When properly used they give results which, taking the nature of the disease into consideration, leave little to be desired. For general purposes there is nothing equal to a solution of nitrate of silver of 10 grains to the ounce of water, in which strength it is chiefly or wholly astringent. Ridgway, in 1812, came to the conclusion that this strength was the best, and precisely the same solution was strongly

¹ I believe, however, that the normal brightness can never be restored to a conjunctiva which has once been granular, probably because it does not really regain the smoothness of health.

recommended by O'Halloran in 1824, who chose it after a prolonged trial of solutions varying from 1 to 30 grains in the ounce. Welch in 1869 still advised it. It is in common use at Moorfields. This solution applied daily with a moderately large camel's hair brush (the common penny brushes) cuts short most inflammatory attacks with great certainty and very much reduces the roughness and redness of the lids in the chronic granular condition, unless this be of very old standing. In a great many cases nothing else is required. After using it for several weeks on a number of children it will be found however that some of them do not improve either as to discharge or the state of the lids. With these either a solution of 20 grains to the ounce may be used, or the mitigated solid nitrate. If the want of effect has reference chiefly to discharge I prefer the 20-grain solution. When, however, the case is one of old thick granular lids the mitigated caustic often has more and better effect, especially as its action can be regulated with considerable nicety. The solutions of the above strength should not be washed off from the conjunctiva unless in a few very irritable cases, and such will generally not be fit cases for treatment by silver at all. The solid diluted nitrate of silver should at first be washed off after 5—10 seconds with a solution of salt (5 grains to the ounce), or of chloride of zinc (2 grains to the ounce), either with a syringe or a large soft brush; but it will be found after a few weeks that in many cases the application thus made has little effect, and it will be necessary either to wait from 15 to 30 seconds or more after applying the caustic before washing it away, or to omit washing it off altogether. The last procedure is perfectly safe in a great many cases from the beginning; but as, if used in this way to all the cases, there is risk of producing increased irritation and corneal ulceration in a certain proportion, the more cautious plan safer. The difference between the effect of washing off the caustic and not doing so may often be advantageously studied by using one method to the right eye and the other to the left of the same patient, supposing that the disease was at first symmetrical in degree. The difference in the amount of improvement is sometimes very markedly in favour of not washing off the caustic, while in others (the more irritable ones) these conditions are reversed. The mitigated caustic should at first never be used oftener than three times a week, though some old cases will be found in which its daily application is necessary. The 10-grain solution must be used daily or three times a week, according to the effect it is found to produce. In applying these solutions I think it is much the best to invert both upper and lower lids and allow a large drop to flow over them, accompanying this with one or two gentle movements of the brush so as to distribute it equally; it is of importance to carry the brush high up above the upper edge of the tarsus in the upper lid, or this part, which is

generally the seat of considerable structural change, will often escape contact with the solution. The same must be done in most cases with the solid caustic, though in this case more care is requisite in order not to touch the cornea; this accident (which has happened to me two, or perhaps three times) can be avoided partly by keeping the point of the caustic forwards instead of backwards and thus slightly lifting the upper lid away from the globe, and partly by pressing the inverted lower lid backwards and upwards, so as to intervene for a short distance between the globe and the upper lid.

Solutions of more than twenty grains to the ounce are unsafe unless washed off, and when this is done they have no advantages over the solid form, and are indeed, less easy to localise than the latter.¹ As a rule I prefer a solution to the solid caustic for young children, who often struggle a great deal, and for those elder children who are unruly; there is some risk of touching the cornea with the solid pencil if the head be suddenly jerked, and this cannot always be avoided even when the child is held between the knees.

A certain number of patients do not improve under the use of silver in any form, nor even when used at long intervals; a few others are made decidedly worse by it, the congestion being permanently increased, the granulations growing rapidly and bleeding on the slightest touch.² Most of these are cases which derive much benefit from solid diluted sulphate of copper (*lapis divinus*) applied two or three times a week, or oftener, according to experience. Such as do not improve under either silver or copper will not, so far as I have seen, do so with preparations of either lead or tannin or tannate of lead. I have not, however, made any extensive or very prolonged trial with these substances, with the exception of the solid acetate of lead of which I shall say more below. Sulphate of copper is not, I think, any safer for average cases than the 10-grain solution of silver, while it is on the whole less efficacious and not so easy to apply, especially to young children. There are some cases in which it does decided harm of the same kind as sometimes follows the silver preparations, and my impression is that these occur oftener under the use of copper than that of silver. For these reasons

¹ Dr. Hairion, however, advises the use of a *concentrated* solution with a *sable-hair* brush, oil being afterwards applied to the conjunctiva. I do not find any statement of the precise strength of his solution. Sable-hair is stiffer than camel's-hair and thus better adapted for applying a minute quantity of solution to a limited part of the conjunctiva.

² In respect to the use of silver in the early period of phlyctenular ophthalmia (whether conjunctival or corneal) complicating granular lids I have not been able to come to any fixed rule. There is no doubt whatever that it often cuts short an attack, and it is equally certain that in a good many it increases the irritation. I think that in the same patient it generally has the same effect during different attacks.

I prefer the solutions of silver as standard applications, reserving the lapis divinus for those who get worse or do not improve under any form of silver. It is a curious fact, which I have several times observed, that children who are made worse by either of these substances are generally benefited in a marked degree by the other. I have been less struck with the necessity of changing the treatment than some other observers, the only decided impression I have on this point being that after no more improvement can be gained by silver, however varied in frequency or degree, the lapis divinus does sometimes carry the case considerably further.

There is no objection to the 10-grain solution of silver being applied by a careful and skilful nurse who has been taught how to use it. This may be quite safely done with a large number of the cases, provided that the medical officer sees them himself at intervals of a few days so as to watch their progress. This is another practical reason in favour of this solution over the lapis divinus, with which in effect it is perhaps most comparable and the use of which could not be left indiscriminately to a nurse.

I have made many careful trials of the solid powdered acetate of lead,¹ both according to the method of Buys, and the modified plan of Gouzeé which consists of applying the salt in a slightly moistened state instead of in dry powder. I applied acetate of lead in more than fifty cases, repeating it two or three times in several of these. The general result was that, when used on Buys' plan, the ordinary (acid) acetate (sugar of lead) had in most cases no effect at all on the granulations beyond whitening them for many months. It slightly increased the discharge when this had been present before, while in a few cases it did decided harm by leading after some months to ulceration of the cornea, due, no doubt, to the apices of the granulations being rendered harder and rougher by its presence than they would have been if left alone. When applied on Gouzeé's method I found that it did harm in a much larger proportion of cases, especially by causing ulceration of the conjunctiva followed by the formation of cicatricial bands which often imprisoned small lumps of the salt beneath them; these rough, projecting nodules and scars often after several weeks or months set up or predispose to relapses of conjunctivitis, and in several cases ulceration of the cornea was produced by them. In one child slight organic entropion occurred, which was, however, easily remedied by removing a horizontal fold of skin. I think, therefore, that the use of powdered salts of lead in the treatment of granular lids should be

¹ It should be mentioned that most of my cases were treated with the ordinary acetate which is acid, not with the neutral acetate as advised by Buys. The only neutral salt I could obtain was supplied under the name of "trisacetate;" it was so sparingly soluble that it would not adhere to the conjunctiva at all, and had no effect on the six cases in which I used it.

definitely abandoned as having no good effect and often a very bad one.

After the application of preparations of silver and copper cold fomentations should be used if there is much pain; they greatly relieve the present pain and the risk (which is generally greatest, I think, when the pain is most severe) of too great inflammatory action setting in.

General management.—This has reference to the general hygiene of the institution in which the children live, to their health, to the avoidance of the causes both of granular disease and of contagious conjunctivitis, and to the general management of those who require constant or intermittent treatment. It is unnecessary to enter into details on the subjects of health and hygiene, since these ought to be raised to as high a standard as possible for every reason, and not solely for the prevention of ophthalmia.

Of the second class of considerations it is needful to go minutely only into the question of preventing contagion. The avoidance of the other causes, although very important, as I have implied by giving them a prominent position, is both obvious and, at the same time, often more difficult to accomplish than this one. Although I have said that I do not think contagion enters so largely as is generally supposed into the causation of any except purulent ophthalmia, and perhaps some occasionally prevalent forms of “catarrhal” ophthalmia, it is none the less necessary that all possible precautions against contagion should be taken, since it is by neglecting them that the worst epidemics are caused and the milder ones aggravated and protracted. In other words, by avoiding contagion we shall prevent epidemics of very bad ophthalmia, and shall to a considerable, although incomplete, extent avoid the permanent establishment in schools of the slighter forms of acute conjunctivitis.

In view of the fact that a very large proportion of acute conjunctival attacks are relapses, *i. e.* occur in those who have suffered in the same way before and are likely to suffer again, I think the first object should be to separate all children whose lids are diseased and who are known to have had acute attacks, or who have chronic conjunctival discharge, from the rest of the school. The ordinary plan of keeping these children among the healthy ones between their attacks and then sending them to the infirmary for a short time till they are cured of the acute symptoms, is miserably inefficient as regards the cure of the disease, is very hurtful to the children so dealt with, and allows them to be a constant source of risk to the healthy ones. The only practicable way of preventing these cases from acting as possible sources of contagion to healthy children is to keep them in an entirely separate building for several years until they have ceased for a year or two to have any relapses, and in order to be complete this must include separate arrangements for teaching

and for play.¹ There is no reason why the buildings need be far removed from one another, although practically, no doubt it will often be best to have them on totally distinct premises.

The important object of avoiding contagion should be kept in view in all the details of such an establishment, but must not be allowed to divert attention too much from other preventible causes of acute ophthalmia. The most important details are—first, the prohibition of basins for washing (except a few for the infants, to be used only by a nurse), and the provision in their stead of the jet system of washing, by which if properly carried out, it is impossible for the same water to be used by two children or for any particles of discharge to adhere to surfaces from which they could be conveyed to the eye; secondly, a very frequent supply of clean towels, or else the provision of a separate towel for each child with arrangements for ensuring that each one always uses the same towel. On the whole I think that as good a result is obtained by the provision at each washing (*i. e.* two or three times daily) of a new and sufficient batch of large round towels, as by distributing a separate towel to each child at each washing, or by elaborate arrangements for keeping each child to the use of the same unchanged towel for several days. It must be borne in mind that when under treatment most of the children will have but little discharge and that the risk of contagion among each other will, therefore, be very small. A provision should be made, however, by which the eyelids of those who have much discharge in the morning should be cleaned carefully before being allowed to wash.² Those who have much discharge in the daytime will of course whilst acute, be warded, and as to the few who constantly have a good deal of chronic discharge it is easy to arrange that they shall have their eyes cleaned separately several times a day. The pocket-handkerchiefs ought to be sewn on to the childrens' dresses, and should be shown to an officer several times a day so as to ensure their not being torn off. Of course no bed should contain more than one child. In respect to bathing, whether this be in separate small baths or in a single large bath, it will be easy to provide, in a properly arranged institution, that the cases with much discharge shall bathe after the other children, and all should be made to wash their faces separately just before bathing. I should not be inclined to adopt any measures of disinfection (except in an institution where there had lately been an epidemic of purulent ophthalmia) beyond ordinary cleanliness of rooms, furni-

¹ This plan was strongly recommended to the authorities of one school by Mr. Critchett several years ago, and is again advocated by Dr. Bridges in his recent 'Report on Ophthalmia' to the Local Government Board.

² An excellent plan, which is carried out by Dr. Duke at Anerley, is to douche each child's face and eyelids with a stream from a fine rose-jet, and then clean off the moistened discharge with bits of tow which are afterwards burnt.

ture, and utensils. Nor would I attempt general disinfection of linen or other clothing or of bedding, except under the same unusual circumstances, and perhaps also in special very bad cases if such should occur.

Much has been said at different times about the necessity of classifying cases according to their degree of severity in the wards and day-rooms, &c. I should think it undesirable that any case of severe purulent ophthalmia should sleep or live in the same room with others not similarly affected, and much more that several such cases should be mixed with comparatively healthy children. It is further desirable that children who are known to be subject to severe relapses should sleep apart from those who are in a more stable condition of cure; the same dormitories might also conveniently include cases with considerable chronic discharge. Beyond this it is not, however, practicable to go, and even to the extent here indicated it will not always be found easy to attain in a school or infirmary with large wards and comparatively few officers, and which is constantly nearly full of children.

There are other reasons besides the prevention of contagion which render the permanent separation of ophthalmic children from healthy ones necessary. The foremost of these, which has been mentioned above, is that the education (using the word in its largest sense) of the ophthalmic children may not be interrupted more than is absolutely necessary while they are suffering or are liable to suffer from the disease. Again, more or less special provisions are desirable for some of them, *e. g.* those with opacities of the cornea or with persistent photophobia, and for others whose general health is bad, for it often happens that ophthalmia attacks most severely those who are least able to resist external causes of disease. To condemn all these children to several years of idleness, or what is almost as bad, to years of intermittent schooling and idleness, is to do them a great injustice, and to add to their already somewhat impaired prospects of earning an early and good living. The bad effect of the ordinary plan on these children must be seen to be appreciated.

Those cases which are not treated personally by the medical officer, or in which all treatment has been omitted for a time, should be inspected by him at moderately short intervals, say once a week.

The playground should, if possible, be of grass, and in default of this either asphalt¹ or flags should be used.

Such an ophthalmic school as is here intended should have wards set apart for its own ordinary sick cases, so that these need not be mixed with the sick children from the rest of the school.

All ophthalmic cases in which the state of the eyes admits of it

¹ Asphalt and tar-paving are more dusty, and dirtier than flags.

should have as much out-of-door exercise as possible, and this may be increased in good weather by out-of-door school. I believe recovery is much retarded by the bad habit, which is not uncommon in these schools and out of them, of keeping all cases of eye-disease in the house and even in darkened rooms, under the impression that light and air are bad for the eyes. As a rule, to which there are certain tolerably well-marked exceptions, both light and air are highly beneficial to patients with granular ophthalmia and its complications, and the exceptions may be reduced to a minimum by the free use of large shades for photophobic cases, and by careful observation of the weather and adjustment of out-door exercise in susceptible cases to its changes.

It is probable that early and slight granular disease will be common among the so-called healthy children who form the main body of such a school and these must be expected to furnish from time to time a few new cases of ophthalmia requiring treatment. The whole school should therefore be inspected at regular intervals by the medical officer with this fact in view. I think that one inspection a week ought to be enough, provided that the other officials are instructed to separate any cases in which there is discharge or redness of the eyeball between the inspections. Every now and then an inspection should be made by the medical officer early in the morning while the children are in bed, and this should be more frequent at times when ophthalmia is known, or expected, to be temporarily on the increase, *e. g.* during prevalence of cold winds and of unusually dusty weather and after excursions or long walks. It will be safest that the arrangements for washing and for pocket-handkerchiefs should be the same as those in the Ophthalmic School, and the playground should, if possible, be a grass field.

Strict measures must be enforced not to admit from outside, among the healthy children, cases of conjunctivitis or of bad granular lids.

With all these precautions fresh cases will arise now and then. These will be more numerous in some years and at some seasons than at others, but they ought always to be detected and separated at an early stage.

Practical Conclusions.

1. Ophthalmia, such as at present is common in some schools, and still exists to a slight extent in the army, is a compound disease consisting primarily of chronic granular disease of the conjunctiva, to which there may or may not be added an acute conjunctivitis. It also includes cases complicated with ophthalmia tarsi.
2. Precisely the same combinations of conjunctival diseases are common among the poor classes of this and other countries as are

found in schools for the children of such people, and in the ranks of the army.

3. Granular ophthalmia had existed for an indefinitely long time in many European countries before the date of the Egyptian campaign.

4. Granular ophthalmia is not produced by contagion or infection. It is caused probably by the action of moist air rendered impure by animal matter (not organized particles). A moderately high temperature seems also to be necessary or very favorable to its development.

5. The cause acts very slowly, a continuous exposure to it of nearly twelve months being probably necessary in order to produce an early stage. It continues to act after the early stage has been formed, and the disease thus becomes worse in proportion to the length of exposure. The severity of the disease also varies directly with the *intensity* of the cause.

6. It is probably impossible in a damp country where the dwellings are much overcrowded to prevent a considerable number of the poorer classes from being affected with slight degrees of granular ophthalmia; but its extensive prevalence in a severe degree shows a culpable neglect of hygienic rules among the body of persons so affected.

7. Granular ophthalmia is the result of a slow local tissue-change, and the tendency to it becomes in time hereditary. It undergoes spontaneous cure after several years, but the conjunctiva does not regain its normal structure or appearance.

8. Many lower animals (mammals and birds) are subject to the same disease.

9. A conjunctiva affected by this disease, while new or progressive, is much less able to resist the causes of acute conjunctivitis than a healthy one; many influences which produce little or no effect on a healthy conjunctiva thus become of importance as causing acute ophthalmia in granulous persons. Such attacks are more prolonged and often more severe than in healthy persons; they tend to increase permanently the degree of the granular disease; they leave behind a more unstable condition of the conjunctiva than preceded them and thus a great liability to relapse.

10. The subjective symptoms and tendency to relapse accompanying granular lids do not correspond in degree with the structural changes in different cases; but both this relation, and the character of the relapses, usually remain constant in each case. The same treatment does not always produce a similar amount of improvement in different cases, but its effect at different times on the same case is generally constant.

11. When the disease has existed a long time without the occurrence of acute conjunctivitis this increased susceptibility to

inflammation gradually lessens, and at length ceases; the prospect of a severe attack of ophthalmia, therefore, becomes smaller in proportion to the length of time that has already elapsed without one since the granular condition began. It is necessary to inspect such cases repeatedly for many months before it can be affirmed with any safety that they have reached this stable condition.

12. Muco-purulent or purulent discharge from the conjunctiva, arising from any cause whatever, is contagious. It will reproduce conjunctivitis but cannot cause granular ophthalmia. The severity of the reproduced disease depends partly on the character of the *contagium*, partly on the condition of the recipient's conjunctiva, and to some extent also on his state of general health.

13. Conjunctivitis of every possible degree is produced by many other causes than contagion. It may assume its severest forms alike in healthy and in granular lids.

14. Except under very bad conditions many of the cases of mild ophthalmia which occur in granulous persons are due to other causes than contagion. Precautions against contagion, while preventing extensive outbreaks of both mild and purulent ophthalmia, will not insure complete immunity from either.

15. Most of the constant causes of conjunctivitis in granulous persons, *e.g.* draughts, damp, dust, measles, are at least partially preventible; but various occasional ones are not so, *e.g.* epidemic influenza and causes depending on climate.

16. Consequently wherever granular ophthalmia is allowed to be very prevalent and attain any severity of degree, attacks of acute conjunctivitis and serious sequelæ of ophthalmia, will be common, unless great precautions be taken to prevent the introduction of contagious cases and the operation of the other constant causes.

17. It is therefore of great importance to diminish the prevalence and the degree of granular ophthalmia, especially in large institutions.

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